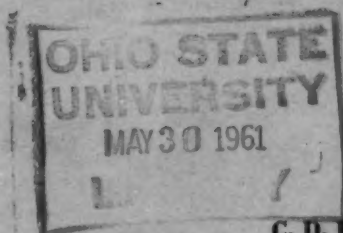


Taxonomy and Distribution of Nearctic Vespula



by

C. D. F. MILLER

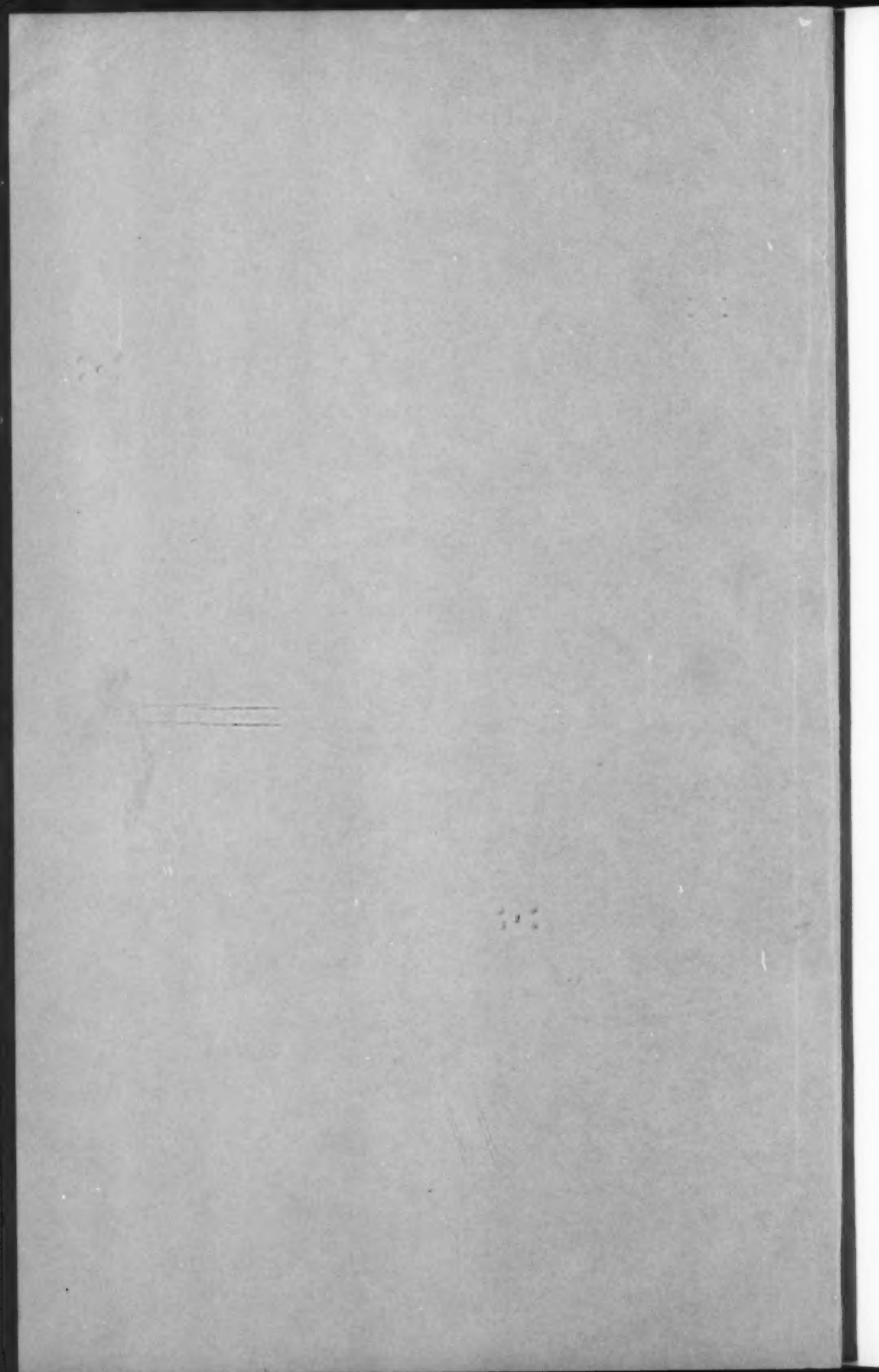
Entomology Research Institute

Research Branch, Canada Department of Agriculture
Ottawa, Ontario

THE CANADIAN ENTOMOLOGIST

Supplement 22

Accompanies Volume XCIII (1961)



**Taxonomy and Distribution
of
Nearctic Vespula**

by

C. D. F. MILLER

Entomology Research Institute
Research Branch, Canada Department of Agriculture
Ottawa, Ontario

THE CANADIAN ENTOMOLOGIST

Supplement 22

Accompanies Volume XCIII (1961)

GL
2
196

196

Int
Ac
M
K
K
1.

2.

3.

4.

5.

6.

7.

8.

C O N T E N T S

	PAGE
Introduction	5
Acknowledgements	5
Methods and Classification	6
Key to Subgenera of <i>Vespula</i>	7
Key to Species and Subgenus <i>Vespula</i>	7
1. <i>Vespula vulgaris</i> Linnaeus	8
Diagnostic Characters	8
Distribution	8
Discussion	10
2. <i>Vespula maculifrons</i> (Buysson)	10
Diagnostic Characters	10
Distribution	10
Discussion	12
3. <i>Vespula pennsylvanica</i> (Saussure)	13
Diagnostic Characters	13
Distribution	13
Discussion	15
4. <i>Vespula acadica</i> (Sladen)	15
Diagnostic Characters	15
Distribution	15
Discussion	17
5. <i>Vespula atropilosa</i> (Sladen)	17
Diagnostic Characters	17
Distribution	17
Discussion	18
6. <i>Vespula austriaca</i> (Panzer)	19
Diagnostic Characters	19
Distribution	19
Discussion	19
7. <i>Vespula consobrina</i> (Saussure)	19
Diagnostic Characters	20
Distribution	20
Discussion	22
8. <i>Vespula intermedia</i> (Buysson)	23
Diagnostic Characters	23
Distribution	23
Discussion	24

	PAGE
9. <i>Vespula squamosa</i> (Drury)	24
Diagnostic Characters	24
Distribution	24
Discussion	26
10. <i>Vespula sulphurea</i> (Saussure)	26
Diagnostic Characters	26
Distribution	26
Discussion	26
11. <i>Vespula vidua</i> (Saussure)	26
Diagnostic Characters	27
Distribution	27
Discussion	27
Key to Species of Subgenus <i>Dolichovespula</i>	28
12. <i>Vespula albida</i> (Sladen)	28
Diagnostic Characters	28
Distribution	28
Discussion	29
13. <i>Vespula arctica</i> Rohwer	30
Diagnostic Characters	30
Distribution	30
Discussion	30
14. <i>Vespula arenaria</i> (Fabricius)	32
Diagnostic Characters	32
Distribution	32
Discussion	36
15. <i>Vespula norvegicoides</i> (Sladen)	36
Diagnostic Characters	36
Distribution	36
Discussion	38
16. <i>Vespula maculata</i> (Linnaeus)	38
Diagnostic Characters	38
Distribution	38
Discussion	41
References	41
Illustrations	42

Taxonomy and Distribution of Nearctic Vespula

By C. D. F. MILLER

Entomology Research Institute
Research Branch, Canada Department of Agriculture
Ottawa, Ontario

Introduction

The most important taxonomic studies on the genus *Vespula* Thomson in North America are those of Sladen (1918) and Bequaert (1930, 1931, 1935, 1941). In 1931, Bequaert published an excellent key to the species and varieties he recognized and recorded taxonomically important distributional and other biological information. In addition he defined the taxa that he recognized and for each gave full bibliographic information. Except for "Additions and Corrections" he published in two subsequent papers, 1935, 1941, Bequaert's 1931 work remained unaltered and unchallenged for twenty years until Bohart in (Muesebeck 1951), in cataloguing the Nearctic species of *Vespula*, treated Bequaert's "varieties" as subspecies by excluding the term "variety" from Bequaert's trinomial combinations. Later Bohart and Bechtel (1957) reviewed many of the species and discussed their composition, basing their work largely on Californian material. Miller (1958) proposed a somewhat different interpretation and arrangement of certain categories based on his studies of geographic variation.

This paper has the following objectives: 1) to present reliable, up-to-date distributional data for each species, 2) to demonstrate the value of correlating distributional data with color patterns to attain an adequate concept of the nature of each species, 3) to apply valid names to the species recognized, 4) to supplement verbal definitions of species with clear, meaningful illustrations, and 5) to designate lectotypes where necessary and subsequently define and stabilize the species concepts within the genus.

Acknowledgments

The author acknowledges indebtedness to Mr. G. S. Walley and Dr. W. R. Mason, Entomology Research Institute, Ottawa, for their constructive criticisms of the manuscript. He is also indebted to Mr. K. V. Krombein, Drs. J. Bequaert and W. L. Brown, Jr., and Dr. H. Deitrich for their valuable assistance during his examination of the collections of *Vespula* at the United States National Museum, Washington, D.C., the Museum of Comparative Zoology, Cambridge, Mass., and Cornell University, Ithaca, N.Y., respectively.

Thanks are due to the following persons in charge of collections at their institutions for the loan of specimens that had distributional information pertinent to this work: Dr. H. Dietrich, Cornell University, Ithaca, N.Y.; Dr. H. H. Ross and Mrs. L. K. Gloyd, Illinois Natural History Survey, Urbana, Ill.; Drs. H. M. Harris and J. L. Laffoon, Iowa State College, Ames, Iowa; Mr. D. Ferguson, Nova Scotia Museum of Science, Halifax, N.S.; Dr. J. N. Knull, Ohio State University, Columbus, Ohio; Dr. F. A. Urquhart and Mr. G. B. Wiggins, Royal Ontario Museum, Toronto, Ont.; Dr. M. T. James, State College of Washington, Pullman, Wash.; Profs. E. H. Strickland and B. Hocking, University of Alberta, Edmonton, Alta.; Prof. G. J. Spencer, University of British Columbia, Vancouver, B.C.; Dr. C. D. Michener, University of Kansas, Lawrence, Kansas; Prof. A. V. Mitchener, University of Manitoba, Winnipeg, Man.; Prof. D. F. Cook, University of Minnesota, St. Paul, Minn.; and Prof. R. D. Shenefelt, University of Wisconsin, Madison, Wisc.

The writer also wishes to thank Mr. R. R. Dreisbach, 301 Helen Street, Midland, Mich., for the loan of specimens from his personal collection. In addition thanks are due to Mr. A. R. Brooks, Research Station, Canada Department of Agriculture, Saskatoon, Sask., for the loan of material from that section of the Canadian National Collection for which he is responsible.

Thanks are also due to persons who participated in the Northern Insect Survey, a cooperative project of the Entomology Division, Canada Department of Agriculture, and the Defence Research Board, Canada Department of National Defence. Through their efforts many of the northern distributional records were obtained.

The writer also wishes to thank Dr. R. M. Bohart, University of California, Davis, Calif., for allowing him to examine the distribution data he compiled for the species *Vespula sulphurea* (Sauss.) before its inclusion in his paper "The Social Wasps in California", which appeared in print in 1957.

Methods and Classification

All the material examined was identified to species and variety by the author with the aid of Bequaert's key and segregated. The geographical distribution of each species was plotted and the geographical variation of each population noted. The data obtained was compared, taxonomic conclusions were made and corresponding nomenclatorial changes inserted.

Generic Concepts.—Those interested in a discussion on the generic and subgeneric treatment of this group are referred to Bequaert (1930 and 1931). The writer has accepted Bequaert's generic and subgeneric treatments because they fit the species involved in this group very well. Therefore, for the purpose of this work, the writer accepts Ashmead's designation of the genus *Vespula* with the type *Vespa austriaca* Panzer, and Rohwer's subdivision of the genus into the subgenera *Vespula* and *Dolichovespula* Rohwer, the type of the latter being *Vespa maculata* Linnaeus.

Species Concepts.—The author recognizes a species as a geographically definable population of freely interbreeding forms. He agrees with Wilson and Brown (1953) that the trinomen is superfluous and unnecessary to describe intraspecific variation at least in the group under consideration.

Bequaert summed up his species concept in the following statement, "Without entering into any formal discussion, I may state that I regard structural characters as of primordial value, and differences or similarities in color or pattern as of secondary importance. Only such forms are given specific rank as are separable by means of reliable structural peculiarities in at least one of the sexes. Groups of specimens differing from one another only in coloration, I consistently treat as forms of a single species, the first described being regarded as the typical form, the others as varieties. Although the term variety is non-committal, since it makes no implication as to the true genetic significance of the particular form in question, I believe, nevertheless, that color varieties are genetically subordinated to structural species. I hold that, in the Diploptera at any rate, of several slow or rapid changes which the organism undergoes in the process of evolution, those that affect color will occur most readily and will also be the least stable; hereditary modifications of structure, on the other hand, are more difficult to produce, but are more permanent once they have appeared. Frequently there is no apparent correlation between the evolutionary changes affecting the color and those influencing structure. Finally, color is more readily affected by environmental factors than structure." Unlike Bequaert, the author accepts *stable color pattern* as supplementary evidence to define species, especially if it can be correlated with geographical distribution. Some of the species of *Vespula* are separable only by

color patterns. These, however, are distinct and to treat them as freely interbreeding populations even when partially or wholly sympatric is indefensible. They appear to be independent entities that are prevented by isolating mechanisms from crossing. A comparative study of the life-histories and habits of the species may eventually disclose the isolating mechanisms involved. This will not be an easy task since the nests are rarely found. In fact, a nest of *Vespula intermedia* (Buysson) has yet to be recorded.

The keys in this work should be used in close conjunction with the prepared illustrations and are based on recognition of species as populations, not as individuals. If the specimen or specimens being identified are not identical with the descriptions or illustrations given they are probably variants of the species to which they key most easily.

Key to Subgenera of *Vespula*

- Oculo-malar space never longer than half the penultimate antennal segment, (Fig. 1); male with aedeagal valves fused throughout, saddle or spoon-shaped distally (Figs. 12-18) *Vespula* (s. str.)
 Oculo-malar space always longer than half the penultimate antennal segments, (Fig. 2); male with aedeagal valves divided distally (Figs. 19-22) *Dolichovespula*

Key to Species of Subgenus *Vespula*

1. Entire length of extensor surface of hind tibia with long, erect hairs (Fig. 5, Map 6) *Vespula austriaca* (Panzer).
 Only proximal portion of extensor surface of hind tibia with long, erect hairs 2
2. Mesonotum with two broad, longitudinal, curved, yellow stripes, not quite reaching anterior and posterior margins 3
 Mesonotum entirely black or with two very short pale stripes near scutellum 4
3. Posterior side of second cubital cell of forewing as long as or slightly longer than that of third cubital cell (Figs. 9, 17, Map 9) *Vespula squamosa* (Drury).
 Posterior side of second cubital cell of forewing almost twice as long as that of third cubital cell (Figs. 10, 18, Map 9) *Vespula sulphurea* (Sauss.).
4. Occipital carina well developed dorsally but obsolete ventrally, never reaching base of mandible (Fig. 4); first abdominal segment narrowed anteriorly, the tergite slightly depressed immediately behind its anterior margin, its pilosity long, erect, and black 5
 Occipital carina well developed throughout, always reaching base of mandible (Fig. 3); first abdominal segment not narrowed anteriorly, the tergite not depressed, its pilosity long, mostly pale, greyish or yellow 9
5. Pale markings whitish 6
 Pale markings yellow 7
6. Abdomen with reddish markings on first and second tergites and sternites (Map 8) *Vespula intermedia* (Buysson).
 Abdomen without reddish markings (Map 7) *Vespula consobrina* (Sauss.).
7. Erect hairs on disks of all abdominal tergites long (sometimes shortened through wear), numerous, and conspicuous; abdominal color patterns as in Figs. 32, 33, 35, 36, 38, 39; facial color patterns as in Figs. 72, 73; digitus of male genitalia nearly half as long as saddle-shaped, distal portion of aedeagus (Fig. 15) 8
 Erect hairs on disks of all but first abdominal tergite short, sparse, and obscure; abdominal color patterns as in Figs. 34, 37, 40; facial color pattern as in Fig. 76; digitus of male genitalia much less than half as long as saddle-shaped, distal portion of aedeagus (Fig. 16, Map 5) *Vespula vidua* (Sauss.).
8. Abdominal color patterns as in Figs. 32, 35, 38; facial color pattern as in Fig. 72; a large, light-colored species (Map 5) *Vespula atropilosa* (Sladen).
 Abdominal color patterns as in Figs. 33, 36, 39; facial color pattern as in Fig. 73; a small, dark-colored species (Map 4) *Vespula acadica* (Sladen).
9. Abdominal color patterns as in Figs. 23, 24, 26, 27, 29, 30; facial color patterns as in Figs. 69, 70; male aedeagal shaft with toothlike expansions at base of terminal spoon (Fig. 12); seventh tergite of male in profile as in Figs. 6, 7, 8 10
 Abdominal color patterns as in Figs. 25, 28, 31; facial color pattern as in Fig. 71; male aedeagal shaft without toothlike expansions at base of terminal spoon (Fig. 13); seventh tergite of male in profile as in Fig. 6 (Map 3) *Vespula pennsylvanica* (Sauss.).
10. Abdominal color patterns as in Figs. 23, 26, 29; facial color pattern as in Fig. 69; seventh tergite of male in profile as in Fig. 6 (Map 1) *Vespula vulgaris* (Linné.).

Abdominal color patterns as in Figs. 24, 27, 30; facial color pattern as in Fig. 70; seventh tergite of male in profile as in Fig. 8 (Map 2).....*Vespula maculifrons* (Buysson).

1. *Vespula vulgaris* (Linnaeus)

Vespa vulgaris Linnaeus, 1758. Syst. Nat., ed. 10, v. 1, p. 572. ♀.

Vespa communis Saussure, 1857. Stettin. Ent. Ztg. 18: 117. ♀.

Vespa alascensis Packard, 1870. Chicago Acad. Sci. Trans. 2: 27. ♀.

Vespa westwoodii Shipp, 1893. Psyche 6: 450.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina complete (reaching base of mandible) (Fig. 3); apex of seventh tergite of male depressed, in profile the base gradually sloping (Fig. 6); shaft of aedeagus with a sharp tooth on each side close to base of terminal spoon (Fig. 12).

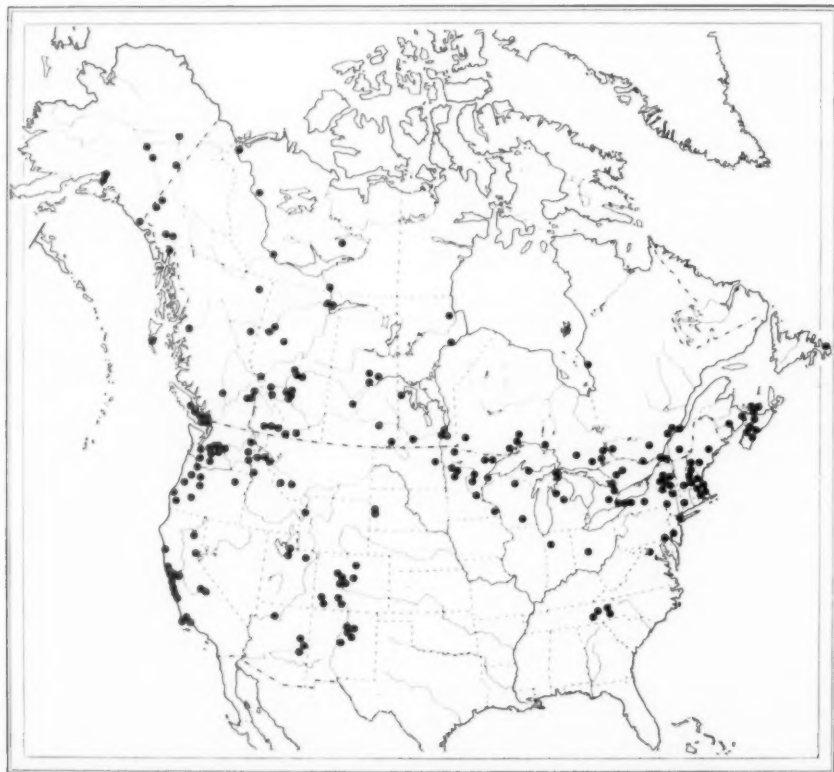
Abdominal color Patterns.—As in Figs. 23, 26, 29.

Facial Color Pattern.—As in Fig. 69.

Distribution

Map 1

This is a Holarctic species which is transcontinentally distributed in the Nearctic region.



Map 1. Nearctic distribution of *Vespula vulgaris* (Linné).

Specimens of this species were examined from the following localities:—

Canada.—*Newfoundland*: St. John's. *Nova Scotia*: Bridgetown; Halifax; Kentville; Petite Rivière; Truro. *Prince Edward Island*: Brackley Beach; Charlottetown; Greenvale. *New Brunswick*: Fredericton; Painsec. *Quebec*: Aylmer; Duchesnay; east coast of James Bay; Hemmingford; Hull; Ironside; Kazabazua; Laniel; Maniwaki; Montreal; Quebec; Sherbrooke; St. Flore. *Ontario*: Biscotasing; Cache Lake; De Grassi Point; Fort William; Grand Bay; Joe Lake; Orillia; Ottawa; Port Sydney; Preston; Red Rock Lake; St. Catharines; Sudbury; Timagami; Toronto; White River; Wilcox Lake. *Manitoba*: Aweme; Churchill; Clandeboye; Gillam; Mafeking; Prairie Grove; Winnipeg. *Saskatchewan*: Christopher Lake; Katepwa Lake; Saskatoon; Waskesiu; Wenoncha; Whitefox. *Alberta*: Aspen Beach; Banff; Bilby; Calgary; Cooking Lake; Dunvegan; Edmonton; Innisfail; Jasper; Lake Athabaska; Lake Borgess; Lesser Slave Lake; New Dayton; Nordegg; Peace Point; Peace River; Red Deer; Waterton. *British Columbia*: Beaver Mouth; Selkirk Mountains; Cranbrook; Departure Bay; Duncan; Fernie; Fort Nelson; Groundhog Basin to Downie Creek; Invermere; Lillooet; Mount Revelstoke; Nanaimo; Nelson; Port Alberni; Robson; Rolla; Terrace; Vancouver; Victoria; Wellington. *Northwest Territories*: Fort Simpson; Fort Smith; Norman Wells; Reindeer Depot; Salamita Mines. *Yukon Territory*: Dazadeash Lake; Dry Creek; Snag; Whitehorse.

United States.—*Maine*: Norway; Orono. *New Hampshire*: Durham; Jaffrey; Milford; North Conway; Shelburne; Squam Lake. *Vermont*: Jacksonville. *Massachusetts*: Cambridge; Forest Hills; Framingham; Stony Creek; Tyngsboro. *Connecticut*: Colebrook. *New York*: Albany; Bisamby; Buffalo; Cooks Falls; Cranberry Lake; Genesee Co.; Hague; Ithaca; Kaaterskill, high peak, 3,800 feet; Keene Valley; Adirondacks; Kolozy; Lockport; Long Island; Mass Pond; Essex Co.; Mount Whiteface; New York; Onteora Mountain, Greene Co.; Pelham; Raquette Lake; Taughanick Falls; Upper Ausable Lake, Essex Co. *Pennsylvania*: Furniss. *New Jersey*: Riverton. *Virginia*: Falls Church. *North Carolina*: Hendersonville; Mount Mitchell. *Michigan*: Cheboygan Co.; Douglas Lake; Kalkaska Co.; Machinac Co.; Marquette; Midland. *Ohio*: Georgesville. *Indiana*: Shades. *Tennessee*: New Found Gap, 5,000 feet; Smoky Mountains. *Wisconsin*: Brule; Douglas Co.; Madison; Vilas Co. *Minnesota*: Basswood Lake; Cass Co.; Houston Co.; Kawishiwi River; Lake Itasca; Lake Vadnais; Mille Lacs; Red Lake Co.; St. Paul; Warroad; Winton. *North Dakota*: Grand Forks. *South Dakota*: Piedmont; Spearfish. *Montana*: Haugan; Pipestone Pass; Skalkaho Pass. *Wyoming*: Grand Teton National Park. *Colorado*: Bayfield, 9,000 feet; Boulder; Buena Vista; Creede; Kiethly Road near Colorado, 9,000 feet; Manitou Park; Pogosa Peak; Rockfield; Colorado Springs; Telluride, 11,000 feet; Tolland. *New Mexico*: Beulah, 8,000 feet; Little Tesuque Canyon; Santa Fe, 9,200 feet; Manzano; Pecos Mountains. *Idaho*: Chatcolet; Moscow; Plummer; Priest Lake; Wallace. *Utah*: Heber; Liberty; Uintah Mountains. *Arizona*: Alpine; Greer; North Rim of the Grand Canyon; San Francisco Mountains. *Washington*: American River; Blewet Pass; Bumping River; Colfax; Colokum Pass; Mount Adams; Mount Rainier; Olympia; Orcas Island; Pullman; Rochester; Rock Island; Spokane; Vancouver; Wenatchii; West Klickitat, 3,500 feet. *Oregon*: Coos Co.; Corvallis; Crater Lake; Dixie Mountains in the Blue Mountains; Hugo; Mary's Peak; Pamela Lake; Portland; Mount Jefferson, 3,000 feet; Three Sisters. *California*: Berkeley; Chester; Creek and Kern Rivers; Cupertino; Giant Forest, Sequoia National Park, 6,500 feet; Gold Lake, Sierra Co.; Hayward; Jasper Ridge, San Mateo Co.; Junction; Miles; Mill Valley, Marion Co.; Monterey; Mount St. Helena, Napa Co.; Mount Hermon, Santa Cruz Co.; Pacific Grove; Petrified Forest; Santa Cruz Mountains;

Sausalito; Sonoma Co. *Alaska*: Anchorage; Big Delta; Chitina River Glacier; Eagle; Fairbanks; Fort Yukon; Matanuska; Skagway; Top Willow Gap Pass.

Mexico.—*Michoacan*: Tancitaro, 6,600 feet. *Mexico*: W. slope Popocatepetl, 10,000 feet.

Discussion

Vespula vulgaris (Linné.) is one of the commonest of the yellow-jackets. It is a Holarctic species that is relatively stable over its entire range. Two types of variants were observed. The first, a xanthic form with a large yellow spot on each side of the propodeum, seems to represent intraspecific variation. It is rare and is sporadically distributed throughout the population. When found in nests it made up less than five percent of each colony. The second, a xanthic form without yellow spots on the propodeum, seems to be the result of hybridization between *V. vulgaris* and *Vespula maculifrons* (Buysson). This variant is more common than the intraspecific one but is restricted to the area where the two species occur together. Two nests from Ottawa, Ontario, contained males, females, and workers of both species and intergradients between them. Also some netted males, females, and workers from other localities in the area where the species occur together were intergradient between them.

It is difficult to explain with the evidence available the evolutionary significance of these variants in the population of *V. vulgaris*. The rarity of the intraspecific variant suggests that it has at the moment little evolutionary effect on the population. The appearance of numerous interspecific variants in the area where *V. vulgaris* and *V. maculifrons* appear together indicates that the genetic barrier between the two populations is not complete.

Ecological Notes.—The nest of this species is terrestrial.

2. *Vespula maculifrons* (Buysson)

Vespa maculifrons (Buysson), 1905. Soc. Ent. France Ann. 63: 608.

Vespa communis var. *flavida* Sladen, 1918. Ottawa Nat. 32: 71. ♀.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina complete (Fig. 3); apex of seventh tergite of male depressed, in profile the base notched (Fig. 8); shaft of aedeagus with a sharp tooth on each side close to base of terminal spoon (Fig. 12).

Abdominal Color Patterns.—as in Figs. 24, 27, 30.

Facial Color Pattern.—as in Fig. 70.

Distribution

Map 2

This species is restricted to the Austral region of eastern North America.

Specimens of this species were examined from the following localities:—

Canada.—*Nova Scotia*: Bridgetown; Halifax; Petite Rivière; Truro. *New Brunswick*: Fredericton; Nerepis. *Quebec*: Aylmer; Chelsea; Covey Hill; Duchesnay; Fort Coulonge; Hemmingford; Hull; Lake Memphremagog; Alexandre. *Ontario*: Carp; Chatham; Claude; De Grassi Point; Foxboro; Gravenhurst; Gull Lake; Leamington; Maple; Marmora; Merivale; Orillia; Ottawa; Point Pelee; Port



Map 2. Distribution of *Vespula maculifrons* (Buysson).

Rowan; Port Sydney; Spencerville; Strathroy; Toronto; Vineland. *Manitoba*: Fort Garry; Morden; Winnipeg.

United States.—*Maine*: Brooksville; Norway; Waldoboro. *Vermont*: Fairlee Lake; Morey; Woodstock. *Massachusetts*: Amherst; Blue Hills Reserve; Cambridge; Dorchester; Dover; Forest Hills; Hanson; Holden; Lexington; Lynn; Milton; Minot; Natick; Petersham; Riverside; Sagamore; Sherborn; Southbridge; Springfield; Stow; Tyngsboro; Waverley; Wellesley; Wellfleet; West Roxbury; Williamstown; Winchendon; Woods Hole. *Connecticut*: Bethlehem; New Haven; Pleasant Valley, Litchfield Co.; Putnam; Stamford; Union. *Rhode Island*: Providence. *New York*: Albany; Brooklyn; Buffalo; Clifton Springs; Coram; Demster; Ellis Hollow; Flushing; Fort Montgomery; Gardner's Island; Hillburn; Ithaca; Jamaica, Long Island; Lake George; Lockport; Medina; McLean; New Russia; Olivera; Plandome, Long Island; Port Jefferson, Long Island; Potsdam; Queens, Long Island; Riverhead; Roslyn; Sea Cliff; Slaterville; Spencer; Spring Lake, Cayuga Co.; Staten Island; Van Courtland Park; Wellesley; West Nyack; West Point; Yonkers; Yorktown Heights. *Pennsylvania*: Bartonsville; Carlisle Junction; Craigheads; Glenside; Harrisburg; Heckton Mills; Highspire; Indian Creek; Ingram; Lehigh Gap; Milton; Mount Union; Northumberland; Overbrook; Philadelphia; Pittsburgh; Rockville; Roxborough; Springbrook; State College; Venango; Washington Co.; Westchester; York Co. *Maryland*: Arundel; Baltimore; Beltsville; Blythedale; Cabin John Br. Chevy Chase Lake; Cupids Bower Island; Edge-

wood; Glen Echo; Hyattville; Jessup; Laurel; Plummer's Island; Silver Hill; Prince Georges Co.; Summerset Heights. *New Jersey*: Alpine; Bergen Co.; Browns Mills; Chatworth; Camden Co.; Dumont; Edgewater; Elwood; Englewood; Fort Lee; Glassboro; Great Notch; Greenwood Lake; Greggstown; Lahaway; Lakehurst; Malaga; Manahawkin; Moorestown; Newfoundland; Ocean Co.; Palisades; Pemberton; Princeton; Rancocas Park; Riverton; Seaside Park; West Englewood. *Virginia*: Accomack Co.; Alexandria; Arlington; Blackpond; Chain Bridge; Charlottesville; Dead Run; Dixieland; Dyke; Fairfax Co.; Falls Church; Farmville; Four-mile Run; Fredericksburg; Glencarlyn; Grange Camp; Great Falls; Hunter; Middle Mountain, 3,000 feet; Millsville; Mount Vernon; Nelson Co.; Norfolk; Petersburg; Rosslyn; Scotts Run; Staunton; Vienna. *West Virginia*: Bangers Springs; Cranberry Glades; Lost River, Hardy Co. *North Carolina*: Black Mountain; Canton; Franklin; Great Smoky Mountain National Park; Hendersonville; Highlands, 4,000 feet; Kill Devil Hills, Dare Co.; Mayoden; Nashville; Raleigh; Southern Pines; Swannanoa; Tryon. *South Carolina*: Batesburg; Santuck; Tiger-ville. *Georgia*: Athens; Atlanta; Billy Island, Okefenokee Swamp; Stone Mountain. *Florida*: Alachua Co.; Chiefland; Dade City; Enterprise; Gainesville; Highlands Co.; Jacksonville; Lakeland; Monticello; South Miami; Torrea Park. *Michigan*: Ann Arbor; Detroit; East Lansing; LaPeer Co.; Midland; Mullet Lake. *Ohio*: Ashton Co.; Columbus, Delaware Co.; Dunnis State Park; Fairfield Co.; Franklin Co.; Greene Co.; Hocking Co.; Ira, Logan Co.; Madison Co.; Pedro; Shaker Heights, Cleveland; Summit Co.; Sargar Grove. *Indiana*: South River; Annapolis; Lake Co. *Kentucky*: Lexington. *Tennessee*: Black Mountain; Burrville; Gatlinburg; Knoxville; Smoky Mountains. *Alabama*: Selma; Tuskegee. *Mississippi*: Oxford. *Wisconsin*: Adams Co.; Columbia Co.; Dane Co.; Douglas Co.; Gays Mills; Hartland; Madison; Milwaukee; Morris; Pierce Co.; Waupaca; Wausau Lake; Wood Co. *Illinois*: Camp Grant; Chicago; Des Plaines; Elsah, Jersey Co.; Galesburg; Jerseyville; Laurenceville; Moline; Urbana; Virginia; Willow Springs; Winnebago Co. *Minnesota*: Aitkin Co.; Ashby; Basswood Lake; Bemidji; Brown Co.; Cannon Falls; Carver Co.; Cass Co.; Chicago Co.; Clear Water Lake; Crookston; Crow Wing Co.; Dakota Co.; Fillmore Co.; Goodhue Co.; Hastings; Hennepin Co.; Houston Co.; Itasca Park; Koochiching Co.; Lakeland; Lake Vadnais; Le Sueur Co.; Mille Lacs Co.; Minneapolis; Norman Co.; Olmstead Co.; Pilliger; Pine City; Ramsey Co.; Red Lake Co.; Republic; Rochester; St. Anthony Park; St. Paul; St. Peter; Taylors Falls; Todd Co.; Wadena Co.; Washington Co.; Winona Co.; Yellow Medicine Co. *Iowa*: Ames; Boone; Burlington; Council Bluffs; Davis Co.; Des Moines; Gilbert; Iowa City; Ledges State Park; Mount Pleasant; Sioux City; Sopus Mills. *Arkansas*: Imboden; Marion Co. *Louisiana*: Lake Charles; Orange. *North Dakota*: Grand Forks. *Nebraska*: Omaha. *Kansas*: Baldwin; Doniphan Co.; Douglas Co.; Hamilton Co.; Lawrence; Manhattan; Wathena. *Oklahoma*: Le Flore Co.; Tuskahoma. *Texas*: Dallas; Fort Worth; Jacksonville; Navasota. *Montana*: Willard. *New Mexico*: Magdalena Mountains.

Discussion

Like *V. vulgaris* this species is relatively stable over most of its range. Where it occurs with *V. vulgaris* it appears to hybridize with it. Like that species it also has a sporadically distributed, rare, xanthic variant with a yellow spot on each side of the propodeum.

Ecological Notes.—The nests of this species are reputedly terrestrial or in well-sheltered places like decayed stumps or hollow logs. The writer's observations confirm the terrestrial habitat.

3. *Vespula pennsylvanica* (Saussure)

Vespa pennsylvanica Saussure, 1857. Stettin. Ent. Ztg. 18: 117. ♀.

Vespa occidentalis Cresson, 1874. Amer. Ent. Soc. Trans. 5: 100. ♀; ♂. Preocc.

Vespa pensylvanica [sic] Bequaert, 1931. Ent. Amer. (n.s.) 12: 95.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment, (Fig. 1); occipital carina complete (Fig. 3); apex of seventh tergite of male depressed, in profile the base very gradually sloping distally (Fig. 6); shaft of aedeagus without sharp teeth at base of terminal spoon (Fig. 13).

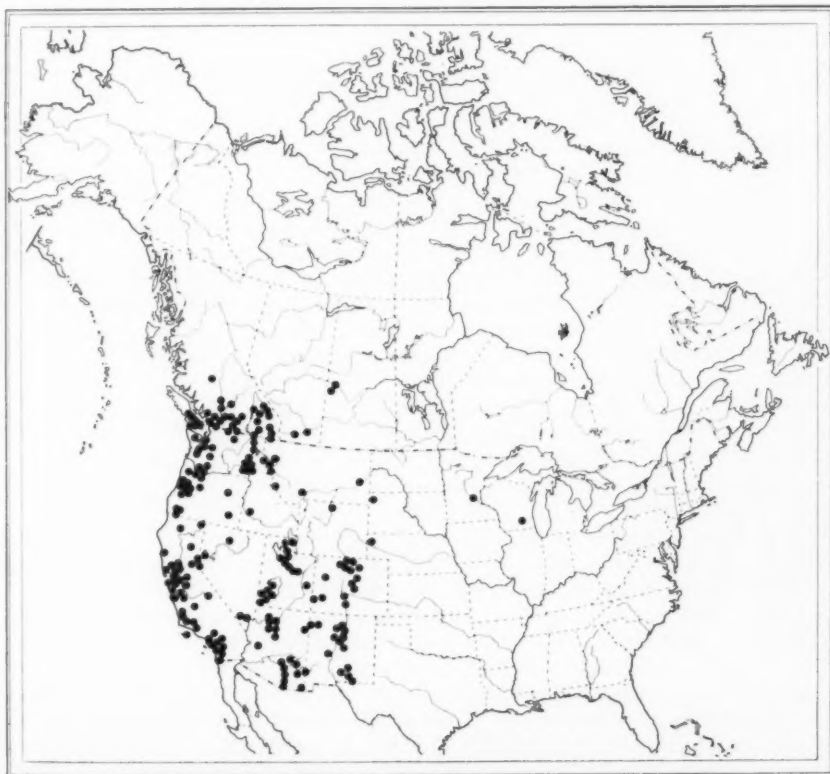
Abdominal Color Patterns.—as in Figs. 25, 28, 31.

Facial Color Pattern.—as in Fig. 71.

Distribution

Map 3

This species is restricted to the Canadian and Transition zones in western North America. It has been taken as far north as Terrace, British Columbia, and Attens Lake, Saskatchewan. Two specimens from Dane Co.; Wisconsin, and Anoka Co., Minnesota, U.S.A., referred to this species are questionable records, but not impossible. They may represent introductions.



Map 3. Distribution of *Vespula pennsylvanica* (Sauss.).

Specimens of this species were examined from the following localities:—

Canada.—*Saskatchewan*: Attens Lake; Cutknife. *Alberta*: Lethbridge; Medicine Hat. *British Columbia*: Alberni; Beaver Mouth; Buccaneer Bay; Chilcotin; Chilliwack; Cranbrook; Departure Bay; Fitzgerald; Gabriola Island; Goldstream; Harrison Mills; Howser, Selkirk Mountains; Invermere; Kamloops; Kalso; Keremeos; Lillooet; Lytton; Merritt; Nanaimo; Newgate; Nicola; Okanagan Falls; Oliver; Osoyoos; Pender Harbour; Peachland; Penticton; Revelstoke; Robson; Royal Oak; Saanich; Sidney; Similkameen; Spillimacheen; Terrace; Thompson River; Trinity Valley; Vancouver; Vancouver Island; Vernon; Victoria; Yale to Hope.

United States.—*Wisconsin*: Dane Co.? *Minnesota*: Anoka Co.? *South Dakota*: Black Hills. *Nebraska*: Sioux Co. *Montana*: Bitterroot Mountains; Bozeman; Butte; Glendive; Haugan; Lookout Pass; Lost Horse Canyon; Missoula; Niarada. *Idaho*: Boise; Coeur d'Alene; Genesee; Juliaetta; Moscow; Moscow Mountain; Potlatch; Priest Lake; Troy; Warren. *Wyoming*: Big Horn Mountains; Hunts Junction. *Colorado*: Black Canyon, Cimarron; Boulder; Buffalo Creek; Clear Creek; Denver; Estes Park, 9,000 feet; Fallen Leaf Lake; Fort Collins; Fort Garland, 8,300 feet; Glenwood Springs; Greeley; Los Pinos; Manitou; Montrose; Palmer Lake; Pingree Park; Larimer Co.; Plainview, Jefferson Co.; Poudre River; Saguache; Salida; Texas Creek. *Utah*: Arch Canyon; Beaver Co. (Beaver Creek Hills, South Creek, Wild Cat Valley); Beaver Valley; Buckskin; Cache Co.; Clover, 5,500 feet; Elk Ridge, La Sal National Forest; Leeds; Logan; Moab; Pine Valley Mountains; Provo; Rains; Salt Lake City; Soldier Summit; St. George; Uintah Mountains; Uintah National Forest; Washington Co.; Weber Canyon; West Jordan; Zion National Park. *New Mexico*: Albuquerque; Bernalillo Co.; Ciehega Canyon, Sandia Mountains; Closson; Cloudcroft; Gila National Forest; Jemez Springs; Magdalena Mountains; McGaffrey; Mountain Park; Pecos; Otero Co.; Ruidoso; Santa Fe; Tajigue; White Mountains. *Arizona*: Angel Trail, Grand Canyon; Apache Co.; Blue River; Chiricahua Mountains; Flagstaff; Fort Grant; Globe; Graham Co.; Humphrey's Peak, 9,500 feet; Kirkland, 4,500 feet; Mount Lemon, Santa Catalina Mountains, 6,000 feet; North Rim of the Grand Canyon; Oak Creek Canyon; Palmerlee; Peebles Valley; Phoenix; Prescott, 8,000 feet; San Francisco Mountains; White House Canyon, Santa Rita Mountains; White Mountains; Williams. *Washington*: Cedar Mountains; Colfax; Klickitat; Lake Crescent; Mount Adams; Orcas Island; Olympia; Palouse; Pullman; Quinault; Roy; San Juan Island; Spokane; Summit Park; Tablerock Mountain; Usk; Vancouver; Wawani; Wenatchee; Whelan; Yakima Co. *Oregon*: Anthony Lake, Blue Mountains; Blitzen River; Corvallis; Crater Lake; Dalles; Dixie; Echo; Forest Grove; Hood River; Kirby; Lane Co.; Mackenzie Pass; McMinnville; Mount Hood; Mount Jefferson; Portland; Pineville; Springfield; Waldport; Yoncalla. *Nevada*: Charleston Park; Elko; Mount Charleston, 7,500 feet; Nye Co.; Ormsby Co.; Reno. *California*: Arroyo Seca, South Pasadena; Avalon, Catalina Island; Alameda Co.; Bakersfield; Benecia; Berkeley; Berdo Co.; Big Springs; Bijou; Bishop; Campe Cook; Carmel; Catalina Islands; Chicho; Claremont; Contra Costa Co.; Corte Madera Creek; Danville; Delmar; San Diego Co.; Descanso; Felton; Geyserville; Giant Forest; Glenellen; Idyllwild; Helena; Jacumba; Jasper Ridge, San Mateo Co.; Laguna Beach; Laguna Mountains; La Jolla, San Diego Co.; Lake Canyon; Lake Tahoe; Leona Heights; Lompac; Los Angeles Co.; Martinez; Menlo Park; Messa Grande; Miles; Mission Valley; Modesto; Modoc Co.; Mona Lake; Monterey; Mount Tamalpais; Nipoma; Oakland Hills; Occidental; Orange Co.; Palo Alto; Paraiso Springs; Pennington; Piedmont; Poway; Rancho Escondido; Redlands; San Bernardino Mountains, 6,200 feet; San Francisco; San Jacinto; San Gabriel Islands; San

Jose; San Louis Obispo; San Mateo; Santa Barbara; Santa Cruz Co.; Santa Cruz Island; Santa Cruz Mountains; Santa Rosa; Santa Rosa Mountains; Sargent; Sausalito; Marin Co.; Shasta Springs; Sierra Madre; Sierra Nevada; Sisson; Sonoma Co.; Stanford University; Tennessee Cove; Three Rivers; Ukiah; Victorville; Warrens; Waters, Sonoma Co.; Watson; West Cliff; Yosemite.

Mexico.—*Michoacan*: Tancitaro, 6,600 feet.

Discussion

Like its close relatives *V. vulgaris* and *V. maculifrons*, this species is relatively stable over most of its range. Xanthic specimens are evidently rare; most of them come from the southern part of the range. The species is readily distinguished over its entire range.

Two female specimens recorded from east of the 100th meridian (from Dane Co.; Wisconsin and Anoka Co.; Minnesota) may have been transported to these localities by man. As yet there is no proof that the species is established in that region. The only other explanation would be a mislabelling of specimens.

Ecological Notes.—Duncan (1939) gives an excellent report on the habits of this species. He describes its nest as terrestrial.

4. *Vespula acadica* (Sladen), New Status

Vespa rufa var. *americana* Buysson, 1905. Soc. Ent. France Ann. 63: 499. ♂ Preocc.

Vespa acadica Sladen, 1918. Ottawa Nat. 32: 72. ♂, ♀, ♂.

Vespa rufa var. *acadica* (Sladen), Bequaert, 1931. Ent. Amer. (n.s.) 12: 80, 81, 101. ♂, ♀.

Vespa rufa var. *sladeni* Bequaert, 1931. Ent. Amer. (n.s.) 12: 80, 81, 102. ♂, ♀.

Vespula acadica (Sladen), Miller, 1958. Proc. Tenth International Cong. Ent., Montreal, 1: 257-264.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina incomplete (not reaching base of mandible), (Fig. 4); abdominal tergites extensively covered with long erect hairs; digitus of male genitalia nearly half as long as distal, saddle-shaped portion of aedeagus (Fig. 15).

Abdominal Color Patterns.—as in Figs. 33, 36, 39.

Facial Color Pattern.—as in Fig. 73.

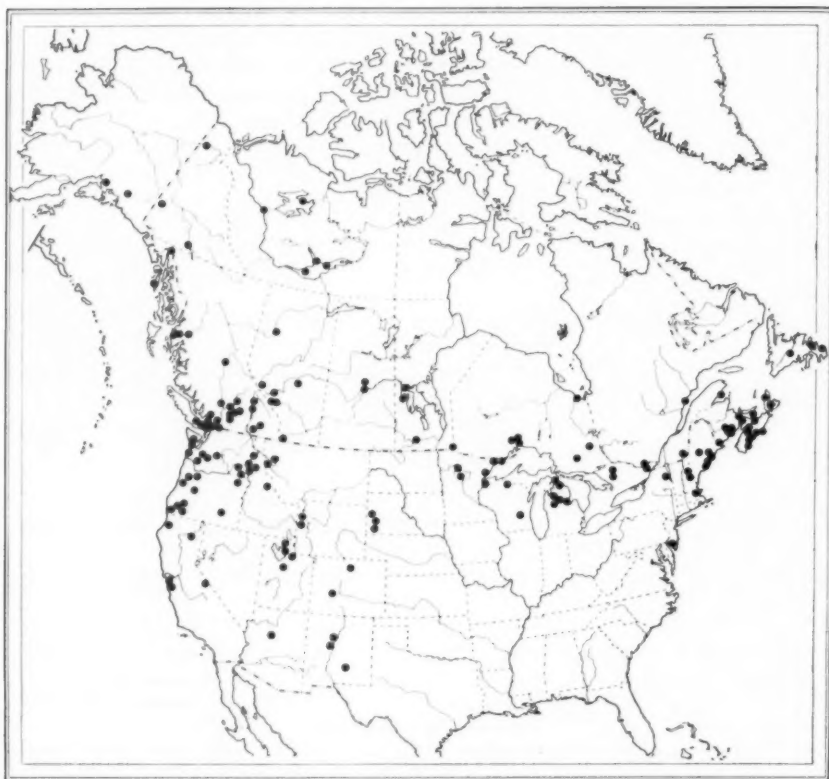
Distribution

Map 4

This Nearctic species is restricted almost entirely to the Canadian zone.

Specimens of this species have been examined from the following localities:—

Canada.—*Newfoundland*: Centre of Island; St. John's; Turks Water, Avalon Peninsula. *Nova Scotia*: Baddeck; Cheticampe; Dublin Shore, Lunenburg Co.; Greenbay; Kentville; MacNabs Island; Petite Rivière; Pictou; Portapique; Smiths Cove; Truro; White Point Beach. *Prince Edward Island*: Brackley Beach. *New Brunswick*: Fredericton; Grey Mills; Nerepis; Painsec; St. John; St. Stephen. *Quebec*: Berthier; Forestville; Ironside; Megantic; St. Godfroi. *Ontario*: Biscoctasing; Fairy Lake; Grand Bay, Lake Nipigon; Lake Nipigon; Macdiarmid; Moose Factory; Ottawa; Port Sidney; Timagami. *Manitoba*: Cedar Lake; Mafeking; Sandilands; Shilo. *Saskatchewan*: Christopher Lake; Prince Albert. *Alberta*: Banff; Jasper; Laggan; Nordegg; Peace River; Waterton. *British Columbia*: Chase; Chillkat Pass; Departure Bay; Douglas Lake; Groundhog Basin; Grouse Mountain; Kamloops; Kaslo; Lillooet; Minnie Lake; Mission City; Prince Rupert; Quesnel;



Map 4. Distribution of *Vespula acadica* (Sladen).

Revelstoke; Robson; Skagit Valley; Squamish; Steelhead; Trinity Valley; Terrace; Tyee; Vancouver; Vancouver Island; Vernon; Victoria. *Northwest Territories*: Fort Norman; Great Bear Lake; Great Slave Lake; Gros Cap; Yellowknife. *Yukon Territory*: Rampart House; Snag; Whitehorse.

United States.—*Maine*: Acadia National Park; Mount Katahdin; North East Harbour; Ocean Point; Waldoboro. *New Hampshire*: Mount Washington; North Conway; Passaconaway. *Massachusetts*: Reading. *New York*: Foot of Cliff Mountain, Essex Co. *New Jersey*: Manamuskin. *Michigan*: Douglas Lake; Iosco Co.; Kalkaska Co.; Missaukee Co.; Mullet Lake; Roscommon Co. *Wisconsin*: Douglas Co.; Madison; Trout Lake. *Minnesota*: Bemidji; Basswood Lake; Cass Co.; Cook Co.; St. Anthony Park; Two Harbours. *South Dakota*: Custer; Pennington Co.; Spearfish. *Montana*: Haugan; Lake Ronan, Lake Co. *Idaho*: Moscow; Rocky Point, Plummer. *Wyoming*: Grand Teton National Park; Stewart River Station. *Colorado*: Boulder Falls, Boulder Co.; Cochetopa National Forest; Pingree Peak. *Utah*: Corrine; Ogden; Uintah Mountains; Utah Lake, east side. *New Mexico*: Cianaga Canyon, Albuquerque; Cloudcroft; Magdalena. *Arizona*: Oak Creek Canyon. *Washington*: Colokum Pass; Copalis; Friday Harbour; Hurricane Hill, Olympic Mountain, 5000 feet; Kalama River; Longmire Springs; Mount Rainier; Mount Adams, 4,500 feet; Nahcotta; Paradise Valley, Mount Rainier; Table Rock Mountain; Yakima Park. *Oregon*: Cascadia Mountains, Marion Co.; Crater Lake,

6,000 feet; Crater Lake Park, Sun Meadow Creek, 7,000 feet; Diamond Lake, 6,000 feet; Granite Mountains, Eagle Creek, 4,000 feet; Grizzly Butte; Lake of Woods, Klamath Co., 5,000 feet; Mary's Peak, Benton Co.; Mount Hood; Mount McLaughlin, Klamath Co.; North Powder; Oregon Mountain, Josephine Co.; Pamela Lake, Mount Jefferson, 3000 feet; Summit Prairie; Three Sisters. *California*: Blue Lake, Humboldt Co.; Chester; Laws; San Francisco; Santa Cruz Mountains. *Alaska*: Anchorage; Copper Center; Sitka.

Discussion

Miller (1958) demonstrated why this entity deserves specific recognition. In order to accept Bequaert's (1931) treatment of this entity as two varieties of *Vespula rufa* (Linné) or Bohart's (1951), in Muesebeck, treatment of it as a subspecies of *V. rufa* or his (1957) treatment of it as a synonym of *Vespula atropilosa* (Sladen) and *Vespula vidua* (Sauss.), one would have to ignore three important facts about it. They would have to ignore, 1) that it has a transcontinental distribution, Map 4, 2) the structural difference Miller (1958) found between it and *V. vidua* and 3) that it maintains its identity even though its distribution is wholly or partially sympatric with other closely related forms such as *V. atropilosa*, *V. vidua*, *V. consobrina* and *V. intermedia*.

Lectotype.—Here designated, ♀, Ottawa, Ont., 17.VI.1916, F.W.L. Sladen, *Rhammus frangula*, type number 6820, Canadian National Collection.

Ecological Notes.—The nest of this species is recorded by Sladen (1918) as being aerial.

5. *Vespula atropilosa* (Sladen), New Status

Vespa atropilosa Sladen, 1918. Ottawa Nat. 22: 72. ♀, ♂.

Vespula rufa var. *atropilosa* (Sladen), Bequaert, 1931. Ent. Amer. (n.s.) 12: 80, 81, 99. ♂, ♀, ♂.

Vespula atropilosa (Sladen), Miller, 1958. Proc. Tenth International Cong. Ent., Montreal, 1: 257-264.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina incomplete (Fig. 4); abdominal tergites extensively covered with long erect hairs; digitus of male genitalia nearly half as long as distal, saddle-shaped portion of aedeagus (Fig. 15).

Abdominal Color Patterns.—as in Figs. 32, 35, 38.

Facial Color Pattern.—as in Fig. 72.

Distribution

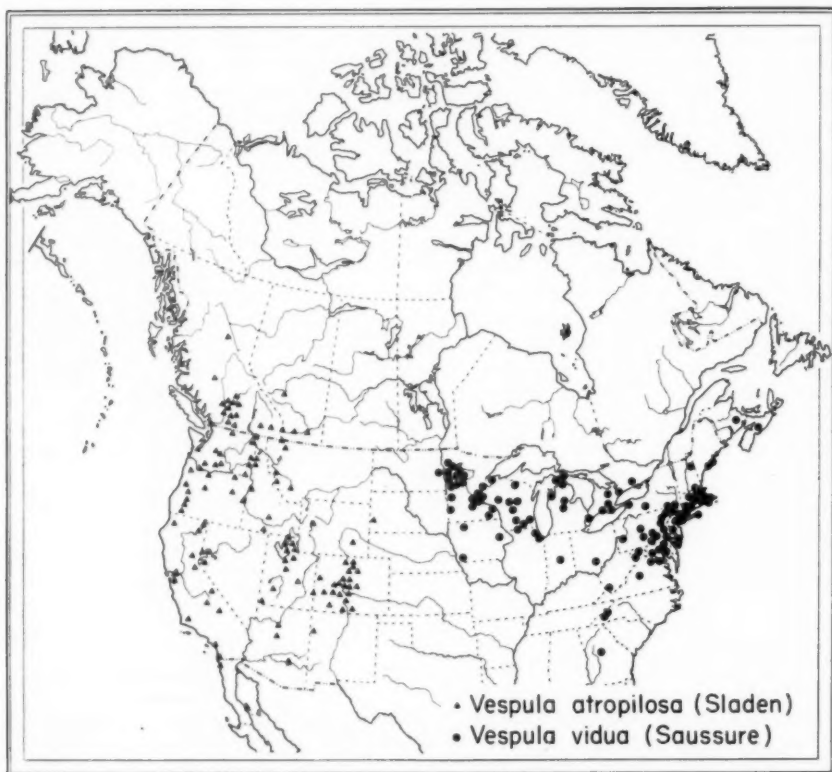
Map 5

This Nearctic species is restricted to the Canadian and Transition zones of the Boreal region in western North America. Specimens have been taken as far north at Fort McLeod, British Columbia, and Medicine Lake, Alberta.

Specimens of this species have been examined from the following localities:—

Canada.—*Alberta*: Lethbridge; Medicine Lake; Pincher; Waterton. *British Columbia*: Chase; Chilcotin; Cranbrook; Fairview; Fort McLeod; Kamloops; Kaslo; Kelowna; Keremeos; Lillooet; Lytton; Merritt; Okanagan Falls; Oliver; Penticton; Summerland; Vernon; Walhachin; Wallander Lake.

United States.—*South Dakota*: Rapid City. *Montana*: Butte; Missoula; Ross Hole, Ravalli Co.; St. Mary's Lake, Glacier National Park. *Idaho*: Bear Lake Valley; Carey; Moscow; Potlach; Troy; Twin Falls. *Wyoming*: Bridge Basin; Crowheart Butte; Wheatland. *Colorado*: Antonito; Boulder; British; Buena



Map. 5. Distribution of *Vespula atropilosa* (Sladen) and *Vespula vidua* (Sauss.)

Vista; Buffalo Creek; Chimney Gulch, Golden; Cimarron; Clear Creek; Colorado Springs; Creede, 8,800 feet; Denver; El Paso Co.; Florissant; Fort Collins; Fort Garland, 8,300 feet; Fremont Co.; Glenwood Springs; Golden; Jim Creek, Boulder Co.; Manitou; Montrose; Oslar, Mill Gulch; Pinecliffe; Plainview, Jefferson Co., 7,500 feet; Rand; Westcliff. *Utah*: Beaver Valley; Bellevue, Washington Co.; Buckskin Valley; Corrine; Emery Co.; Fish Lake; Hanna; Logan; Newton; Ogden; Park City; Provo; Salt Lake City; Weber Canyon. *New Mexico*: Closson. *Arizona*: Globe; Oak Creek Canyon; San Francisco Mountains. *Washington*: Blue Mountains; Colokum Pass; Colville; DuPont; Mount Adams, 3,000 feet; Northport; Pine Val Mountains, 6,000 feet; Pullman; Usk; Vancouver; Wenas; White Swan; Yakima. *Oregon*: Athena; Corvallis; Crater Lake Park, 6,000 feet; Diamond Creek, White Mountains; Dixie; Grizzly Butte; Klamath Falls; Ontario; Portland; The Dalles; Three Sisters. *Nevada*: Ormsby Co.; Reno; Wadsworth. *California*: Alturas, Modoc Co.; Angora Lake, Tahoe; Berkeley; Bishop; Carrville, Trinity Co., 2,400 feet; Chino; Fort Bidwell, Siskiyou Co.; Giant Forest, 6,700 feet; Lake Tahoe; Laws; Piedmont; Portola; Tejon Pass.

Mexico.—Tia Juana.

Discussion

Miller (1958) demonstrated why this entity deserves specific recognition. Like *V. acadica* it is readily distinguished over its entire range. The rare occurrence of male specimens, which have intergradient color patterns between it and

V. acadica, is unexplainable with the evidence available. It might be assumed that they are the result of hybridization between the two species or overlapping intra-specific variation (parallel evolution). The author continues to recognize *V. atropilosa* as a good species.

Lectotype.—Here designated, ♀, Lethbridge, Alta., 24.V.1915, F.W.L. Sladen, 4013, type number 6821, Canadian National Collection.

Ecological Notes.—The nest of this species is reported by Bohart (1957) as being terrestrial.

6. *Vespula austriaca* (Panzer)

Vespa austriaca Panzer, 1799. Fauna Ins. German, n. 63, pl. 2. ♂.

Vespa infernalis Saussure, 1853. Etudes sur la famille des Vespides, v. 2, p. 139. ♀.

Vespa tripunctata Packard, 1870. Chicago Acad. Sci. Trans. 2: 26. ♀.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Neuter caste lacking; malar space less than half as long as the penultimate antennal segment; apical margin of the female clypeus much projecting, with prominent raised lateral angles; extensor surface of hind tibiae bearing long erect hairs, scattered over the entire length (Fig. 5); male genitalia as in Fig. 14.

Abdominal Color Patterns.—as in Figs. 42, 45.

Facial Color Pattern.—as in Fig. 77.

Distribution

Map 6

This is a Holarctic species which, though widespread throughout the Boreal region of North America, is rare in comparison to most others.

Specimens of this species have been examined from the following localities:—

Canada.—*Quebec*: Chelsea; Duchesnay; Great Whale River; Montreal; Rupert House; St. Alexandre. *Ontario*: Fort William; Low Bush; Macdiarmid; Ottawa. *Manitoba*: Winnipeg. *Saskatchewan*: Macklin. *Alberta*: Banff; Fawcett; Jasper; Nordegg. *British Columbia*: Beaver Mouth, Selkirk Mountains; Bridge Lake; Field; Kamloops; Kalso; Lillooet; Mount Cheam; Robson. *Northwest Territories*: Coppermine; Fort Norman.

United States.—*New York*: Keeseville; Staten Island. *New Jersey*: Fort Lee. *Idaho*: Moscow; Moscow Mountain. *Colorado*: Creede; Lyons; Pinecliffe. *New Mexico*: Little Tesuque Canyon; Santa Fe. *Utah*: Mount Tikhnikivats, La Sol Mountains; Round Valley. *Washington*: Mount Rainier Park, 6,000 feet. *Oregon*: Crater Lake; Mount Hood; Lincoln Co.; Lucky Boy Camp, Blue River; Three Sisters. *Alaska*: Anchorage; Savonoski. *California*: Yosemite Valley.

Discussion

This species is relatively stable over its entire range.

Ecological Notes.—In Europe this species has been recorded from nests of *Vespula rufa* (Linné.). So far it has never been taken from a nest of a Nearctic species, however, an examination of its range indicates that it could be parasitic on a number of species especially those which have close structural affinities to *V. rufa*. Further study of this species should reveal its parasitic habits here.

7. *Vespula consobrina* (Saussure), New Status

Vespa consobrina Saussure, 1864. Etudes sur la famille des Vespides, v. 2, p. 141. ♀.

Vespa scelestus McFarland, 1888. Amer. Ent. Soc. Trans. 15: 298. ♂, ♀, ♂.

Vespa sulcata Howard, 1901. Insect Book, pl. 6, fig. 18. ♀. (Without locality or description).



Map 6. Nearctic distribution of *Vespa austriaca* (Panzer).

Vespa rufa var. *consobrina* (H. de Saussure), Bequaert, 1931. Ent. Amer. (n.s.) 2: 79, 82, 104. ♂, ♀, ♂.

Vespa consobrina (Saussure), Miller, 1958. Proc. Tenth International Cong. Ent., Montreal, 1: 257-264.

Diagnostic Characters

Color.—Black with white markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina incomplete (Fig. 4); abdominal tergites extensively covered with long erect hairs; digitus of male genitalia nearly half as long as the distal, saddle-shaped portion of the aedeagus (Fig. 15).

Abdominal Color Patterns.—as in Figs. 41, 44, 47.

Facial Color Pattern.—as in Fig. 74.

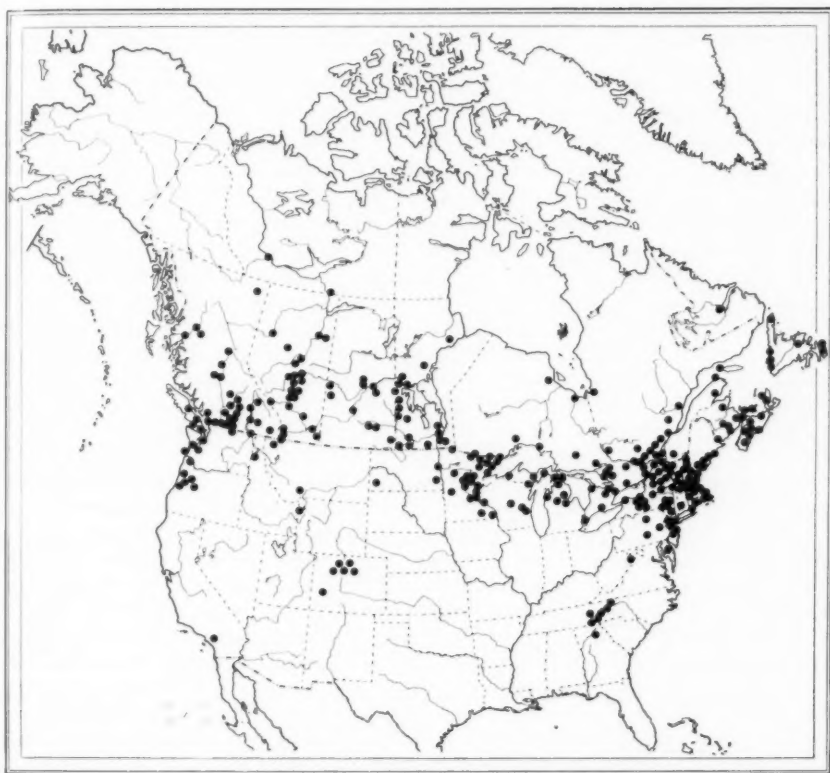
Distribution

Map 7

This Nearctic species is widely distributed throughout the Canadian and Transition zones of the Boreal region of North America.

Specimens of this species have been examined from the following localities:—

Canada.—*Newfoundland*: Gander; Goose Bay; Humber Mouth, Bay of Islands; Sprucebrook; St. Anthony's; St. George; St. John's; Turks Water, Avalon Penin-

Map 7. Distribution of *Vespa consobrina* (Sauss.).

sula. *Nova Scotia*: Baddeck; Brierly Brook, Antigonish Co.; Cheticampe; Dublin Shore, Lunenburg Co.; Green Bay, Lunenburg Co.; James River; Kentville; Mac-Nab's Island; Petite Rivière, Lunenburg Co.; Portapique; Truro. *Prince Edward Island*: Brackley Beach; Dalvay House. *New Brunswick*: Fredericton; Nerepis; Painsec; St. John; St. Stephen; Tabusintec. *Quebec*: Abbotsford; Aylmer; Cascadepia; Covey Hill; Duchesney; Ellis Bay; Anticosti Island; Fort Coulonge; Grand Vallee, Gaspé; Gull Lake; Hemmingford; Joliette; Kazabazua; Lac Nominique, La Belle Co.; Lake Edward Camp, Laurentide; Laniel; Montreal; Rupert House; Saguenay River; Sherbrooke; St. Flore; St. Jean; St. Rose; Val Morin. *Ontario*: Attawapiskat; Aylmer; Biscotasing; Chalk River; Chatham; De Grassi Point; Elsinore; Gravenhurst; Honey Harbour; Hornings Mills; Huntsville; Macdiarmid; Marmora; Moose Factory; Muskoka; Ottawa; Port Sydney; Spencerville; Timagami; Toronto; White River. *Manitoba*: Atikameg Lake; Aweme; Birch River; Brandon; Cedar Lake; Deepdale; Fort Garry, Winnipeg; Herchemer; Hortney; Keld; Le Pas; Mordin; Novra; Pikwitonei; Red Deer River; Stonewall; Teulon; Winnipeg. *Saskatchewan*: Christopher Lake; Crest; Indian Head; Lashburn; Regina; Rutland; Saskatoon; Waskesiu Lake; Wenoncha; Whitefox. *Alberta*: Aspen Beach; Athabaska; Banff; Bilby; Brooks; Calgary; Cooking Lake; Cowley; Cypress Hills; Edmonton; Fawcett; Fort McMurray; Gull Lake; Innisfail; Lacombe; Lesser Slave Lake; Medicine Hat; Peace River; Pincher Creek; Red Deer; Wabamun;

Waterton; Waterways. *British Columbia*: Aspen Grove; Beaver Mouth; Chilcotin; Chilliwack; Departure Bay; Fitzgerald; Fort McLeod; Fort Nelson; Fort Steele; Hazelton; Kamloops; Kaslo; Kelowna; Keremeos; Merritt; Mission City; Nakusp; Nicola; Penticton; Peters Lake; Revelstoke; Robson; Royal Oak; Salmon Arm; Sicamous; Sidney; Squamish; Terrace; Vancouver; Vancouver Island; Vernon; Williams Lake; Yale. *Northwest Territories*: Fort Simpson; Fort Smith.

United States.—*Maine*: Acadian National Park; Boothbay; Cape Rosier; Hancock Co.; Lebanon; Monmouth; Southport; South West Harbour; Squirrel Island; Waldoboro. *New Hampshire*: Alstead; Centre Harbour; Claremont; Dixville Notch, 1,800 feet; Durham, White Mountains; Shelburn; Nelson; North Conway. *Vermont*: Chittenden; Fairlee Lake; Montgomery; Stowe. *Massachusetts*: Boston; Cambridge; Dover; Forest Hills; Holden; Lexington; Milton; Mount Grey Lock; Nahant; Petersham; Princeton; Sayamore; Springfield; Stony Brook Reserve; Tynsboro; Winchendon; Woods Hole. *Connecticut*: Colebrook; Lyme. *Rhode Island*: Providence. *New York*: Axton; Adirondack Mountains; Benson Mines; Big Indian Valley, Catskills; Big Valley, Catskills; Big Moose; Connecticut Hill, Tompkins Co., 2,000 feet; Cooks Falls; Fort Montgomery; Heart Lake, Essex Co.; Indian Falls, Mount Marcy; Ithaca; Keene Valley, Essex Co.; Lake George; Lockport; McLean; Mount MacIntyre, Essex Co.; Mount Skylight, Essex Co., 5,000 feet; Newcomb; Newport; New Russia; North Fairhaven; Oliveria; Onteora Mountain, Greene Co.; Piseco; Raquette Lake; Saranac Lake; Stony Point; Taughanick Falls; Upper Ausable Lake, Essex Co. *New Jersey*: Alpine; Boonton; Greenwood Lake; Lake Hopatcong; Lake Hurst; Palisades; Riverton; West Englewood. *Pennsylvania*: Ganoga Lake; Heckton Mills; Lehigh Gap. *Delaware*: Dover. *Virginia*: Lost River State Park, Hardy Co. *North Carolina*: Black Mountains; Blowing Rock; Franklin; Linville Falls; Mount Mitchell; Sunburnt, Hagwood Co.; Swannanoa. *Georgia*: Yonah Mountain. *Michigan*: Cedar River; Cheboygan Co.; Clare Co.; Gladwin Co.; Douglas Lake; Manistee Co.; Midland Co.; Mullet Lake; Schoolcraft Co.; Watersmeet. *Tennessee*: Tiemont, Great Smoky Mountain Park. *Wisconsin*: Cranmoor; Door Co.; Gays Mills; Green Lake; Hartland; Madison; Milwaukee; Pierce Co.; Plover; Sawyer Co.; Vilas Co.; Walker. *Minnesota*: Aitken; Alexandria; Babbitt; Basswood Lake; Burntside Lake; Chisago Co.; Comstock Lake; Crow Wing Co.; Ely; Garrison; Gramer; Grand Maris; Houston Co.; International Falls; Koochiching Co.; Lake Itasca; La Porte; Lutsen; Mille Lacs; Owatonna; Pine City; Ramsay Co.; Republic; St. Anthony Park; Tamarack; Tower; Two Harbours; Warroad; Wassau Lake; Willow River; Winton. *North Dakota*: Fargo; Grand Forks; Sully's Hill National Park. *Montana*: Bozeman; Glacier Park Station, 4,800 feet. *Wyoming*: Jackson. *Colorado*: Boulder; Cameron Pass, 9,500 feet; Clear Creek Canyon; Gold Hill; Kremmling, Grand Co.; Montrose; Peaceful Valley; Rabbit Ear Pass; Red Feather Lakes, 8,000 feet. *Idaho*: Coeur d'Alene. *Washington*: Nahcotta; Olympia; Orcas Island; Seattle; Shelton. *Oregon*: Alsea Mountain, Benton Co.; Cascadia; Corvallis; Florence; Rainier. *California*: Red Lands.

Discussion

Miller (1958) demonstrated why this species deserves species recognition. It is easily identified over its entire range which is partially or wholly sympatric with other closely related species such as *V. atropilosa*, *V. vidua*, *V. acadica* and *V. intermedia*. There are no intergrades between it and any of these species. There is no available proof that they do not interbreed but if they do, there is no perceptible evidence to prove it. The writer recognizes this entity as a good species.

Ecological Notes.—The nest of this species is usually terrestrial, however, it has been known to build nests just above the ground in low shrubs or brushwood.

8. *Vespa intermedia* (Buysson), New Status

Vespa rufa var. *intermedia* Buysson, 1905. Soc. Ent. France Ann. 73: 591. ♂, ♀.

Vespa intermedia (Buysson), Miller, 1958. Proc. Tenth International Cong.

Ent., Montreal, 1: 257-264.

Diagnostic Characters

Color.—Black with yellow and reddish markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina incomplete (Fig. 4); abdominal tergites extensively covered with long erect hairs; digitus of male genitalia nearly half as long as distal, saddle-shaped portion of aedeagus (Fig. 15).

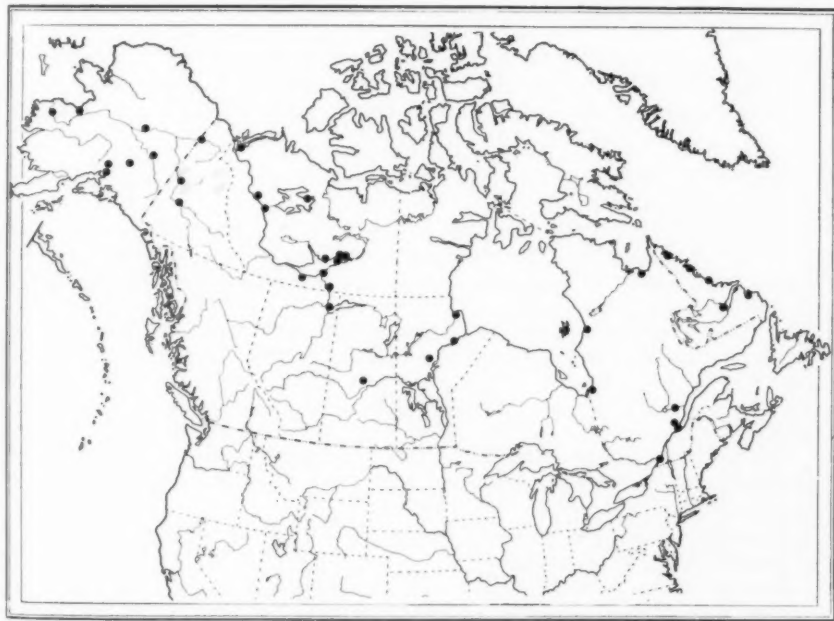
Abdominal Color Patterns.—as in Figs. 43, 46, 48.

Facial Color Pattern.—as in Fig. 75.

Distribution

Map 8

This Nearctic species is restricted almost entirely to the Hudsonian zone of the North American Boreal region.



Map 8. Distribution of *Vespa intermedia* (Buysson).

Specimens of this species have been examined from the following localities:—

Canada.—*Newfoundland*: Anatalak Bay; Cartwright; Goose Bay; Hopedale; Nain; Rama. *Quebec*: Chicoutimi; Fort Chimo; Great Whale River; Island of Orleans; Lac Jacques Cartier; Longueuil; Rupert House. *Manitoba*: Churchill; Churchill River; Gillam. *Saskatchewan*: Christopher Lake. *Alberta*: Athabaska Delta. *Northwest Territories*: Aklavik; Fort Norman; Fort Smith; Great Bear

Region; Gros Cap; Hay River; McLeod Bay, Great Slave Lake; Norman Wells; Pearson; Resdelta; Snowdrift. *Yukon Territory*: Dawson; Rampart House; Selwyn.

United States.—*Alaska*: Anvik; Big Delta; Kutleet; Lower Yukon River; Matanuska; Mount McKinley Park; Palmer.

Discussion

Miller (1958) demonstrated why this species deserved specific recognition. Its range partially overlaps that of other closely related forms but there is no perceptible sign that they interbreed. This species like *V. acadica*, *V. atropilosa*, *V. vidua* and *V. consobrina* maintains its identity wherever it is found.

The author recognizes this species as specifically distinct.

Ecological Notes.—A nest of this species has yet to be found. It is probably terrestrial in its nesting habits.

9. *Vespula squamosa* (Drury)

Vespa squamosa Drury, 1773. Illus. Nat. Hist. Index to pt. 1 published with pt. 2.

Vespa lineata Fabricius, 1775. Systema Ent., p. 365.

Vespa conchacea Christ., 1791. Naturgesch. Insekt. Bienen, Wespen u. Ameisengeschl., p. 259.

Vespa cuneata Fabricius, 1804. Systema Piezatorum, p. 258.

Vespa cruciata Lepeletier, 1836. Hist. Nat. Ins. Hym., v. 1, p. 513. Emend. of *cuneata*.

Vespa bistriata McFarland, 1888. Amer. Ent. Soc. Trans. 15: 298. ♀. Preocc.

Vespa macfarlandi Lewis, 1897. Amer. Ent. Soc. Trans. 24: 172. ♀. N. name.

Vespula squamosa var. (or subsp.) *michoacana* Bequaert. Ent. News 52: 249-250.

Diagnostic Characters

Color.—Queen, orange with black markings. Male and worker, black with yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina incomplete (Fig. 4); posterior side of second cubital cell of forewing equal to or slightly longer than that of third cubital cell (Fig. 9); male genitalia as in Fig. 17.

Abdominal Color Patterns.—as in Figs. 49, 52, 55.

Facial Color Pattern.—as in Fig. 78.

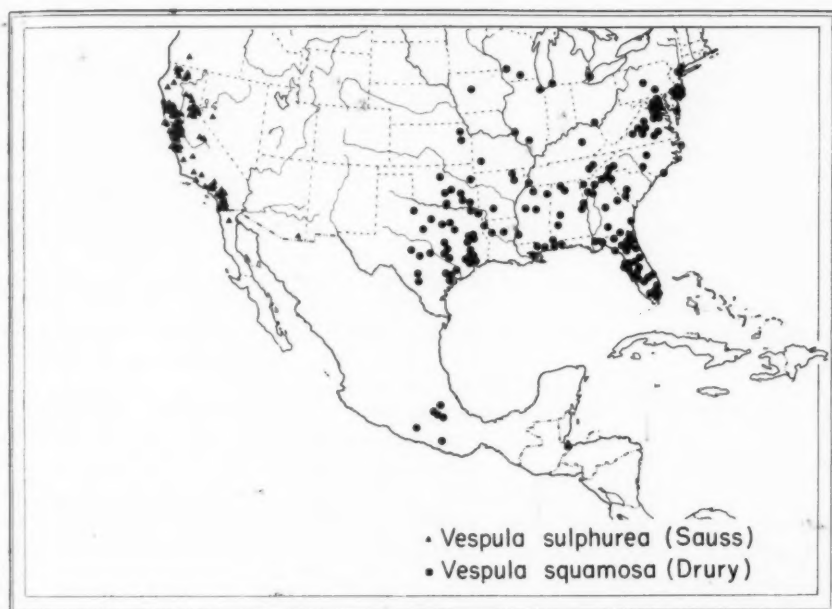
Distribution

Map 9

This Nearctic species is widely distributed in the southeastern part of the Transition, Upper Austral and Lower Austral zones of the Austral region of North America.

Specimens of this species have been examined from the following localities:—*Canada*.—*Ontario*: Point Pelee.

United States.—*New York*: New York; Pelham Parkway. *Pennsylvania*: Heckton Mills; State College. *New Jersey*: Bay Ridge; Clementon; Englewood Cliffs; Lakehurst; Manumuskine; Mount Holly; Pitman; Rancocas Park; Riverside Park; Riverton; South Seaville; Westville. *Maryland*: Baltimore; Beltsville; Berwyn; Bladensburg; Chevy Chase Lake; George Co.; Glen Echo; Indian Head; Laurel; Plimmers; Salisbury; Silver Hill, Prince George Co. *District of Columbia*: Washington. *Virginia*: Auburn; Charlottesville; Dyke; Falls Church; Farmville; Ford; Fredericksburg; Glencarlyn; Nelson Co.; Petersburg; Veitch; Vienna; Wingina. *North Carolina*: Asheville; Kill Devil Hills; Raleigh; Southern Pines; Southport. *South Carolina*: Aiken; Anderson; Batesburg; Clemson. *Georgia*:



Map 9. Distribution of *Vespa squamosa* (Drury) and *Vespa sulphurea* (Sauss.).

Austell; Billy Island, Okefenokee Swamp; Chickamauga National Military Park; Clayton; Fort Valley; Nacoochee Valley; Stone Mountain; St. Simons; Thomson's Mills; Tifton. *Florida*: Boynton; Cedar Keys; Crescent City; Daytona; Efers; Fort Lauderdale; Fort Mead; Gainesville; Golden Head Branch State Park, Cloy Co.; Green Ridge; Haines City; Highlands Hammock State Park, Highlands Co.; Jacksonville; La Belle; Lacoochee; Lake Placid; Lake Worth; Lantana; Leon Co.; Monticello; Moon Lake; Ocala; Orlando; Palm Beach; Palatka; Pasco Co.; Quincy; Sanford; Sebastian; Silver Springs; St. Augustine; St. Petersburg; Suwanee Springs; Winter Park. *Michigan*: South Haven. *Ohio*: Pedro. *Kentucky*: Lexington. *Tennessee*: Knox Co.; Knoxville; Memphis. *Alabama*: Auburn; Decatur; Fairhope; Landale, Chambers Co.; Mobile; Selma; Springhill; Thomasville, Clark Co. *Mississippi*: A & M College; Biloxi; Fulton; Greenwood; Gulfport; Holly Springs; Natchez; Oxford. *Wisconsin*: Gays Mills; Madison. *Iowa*: Ames. *Illinois*: Chicago; Dubois. *Missouri*: St. Louis; Willard. *Kansas*: Douglas Co.; Leavenworth Co. *Arkansas*: Hope; Imboden; Lawrence Co. *Oklahoma*: Ardmore; Flint; Hugo; Perkins; Seminole Co.; Stillwater; Tuskahoma; Wilburton. *Louisiana*: Frierson; Lake Charles; Natchitoches; New Orleans; Savannah; Winnfield. *Texas*: Altair; Ardmore; Austin; Calvert; Colorado Co.; Crosby; Cypress Mills; Dallas; Dallas Co.; Eastland Co.; Fort Worth; Harper; Haskell; Hockley; Houston; Huntsville; Jacksonville; Karnock; Kerr Co.; Kerrville; Lee Co.; Merkel; Taylor Co.; Navasota; New Boston; Paris; Rusk; Santo; Seagoville; Tampa; Uvalde; Victoria; Victoria Co.; Waco; Wallisville; Willis.

Mexico.—*Hidalgo*: San Miguel. *District Federal*: Eslava; Mexico; San Angel; Tubyhualco. *Puebla*: Puebla. *Michoacan*: Tancitaro. *Oaxaca*: Nichixtlan. *Chiapas*: San Cristobal las Casas, 7,500 feet.

Guatemala.—Puerto Barrios.

Discussion

One has little difficulty in recognizing this species which is distinct over most of its range. An intraspecific variant which seems to be geographically definable has been located in the mountains of southern Mexico. The amount of material available for the study of this variant is so little that to make a conclusion on its genetic value to the *V. squamosa* population would be pure speculation. It appears to be a melanistic form which could be the result of climatic conditions in the area in which it has been found. Bequaert called this a subspecies of *V. squamosa*. The author treats it as a variant of this species not worthy of nomenclatorial recognition.

Ecological Notes.—The nest of this species was considered to be terrestrial until Tissot and Robinson (1954) proved it to be aerial as well. A study of the nesting habits of this species over its entire range may prove to be an interesting thesis.

10. *Vespula sulphurea* (Saussure)

Vespa sulphurea Saussure, 1854. Etudes sur la famille des Vespides, v. 2, p. 137. ♀.

Diagnostic Characters

Color.—Black with numerous yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina incomplete (Fig. 4); posterior side of second cubital cell of the forewing nearly twice as long as that of the third cubital cell (Fig. 10); male genitalia as in Fig. 18.

Abdominal Color Patterns.—as in Figs. 50, 53, 56.

Facial Color Pattern.—as in Fig. 79.

Distribution

Map 9

This Nearctic species is restricted almost entirely to the Upper Sonoran Fauna of California.

Specimens have been examined from the following localities:—

United States.—*Arizona:* Huachuca Mountains. *Nevada:* Oregon: Butte Falls. *California:* Arroyo Seca River; Beaumont; Benecia; Berkeley; Boulevard; Bradley, Monterey Co.; Carasexo; Carrville, Trinity Co., 2,500 feet; Claremont; Contracosta Co.; Cypress Ridge, Marin Co.; Descanso, San Diego Co.; Geyserville; Idyllwild; Jacumba; Jamesburg; Jasper Ridge, San Mateo Co.; Kern Co.; Los Angeles; Los Gatos Canyon, Fresno Co.; Mission Valley; Monticello; Mount Lowe; Mountains near Claremont; Onyx; Palo Alto; Paraiso Springs; Pasadena; Putah Creek, Monticello; Redlands; San Jacinto Mountains; San Bernardino Co.; Soquel; Stanford University; Upper Santa Ana River; Voltaire, Los Angeles Co.; Warrens, San Diego Co.; Watsons, Sonoma Co.; Winters.

Mexico.—Baja California.

Bohart and Bechtel (1957) give a more complete distribution for this species.

Discussion

The taxonomy of this species poses no problem. It is easily recognized and very restricted in its distribution.

Ecological Notes.—The nest of this species is recorded as terrestrial.

11. *Vespula vidua* (Saussure), New Status

Vespa vidua Saussure, 1854. Etudes sur la famille des Vespides, v. 2, p. 136.

Vespula rufa var. *vidua* (Saussure), Bequaert, 1931. Ent. Amer. (n.s.) 12: 80, 81, 100. ♂, ♀, ♀.

Vespula vidua (Saussure), Miller, 1958. Proc. Tenth International Cong. Ent., Montreal, 1: 257-264.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space less than half as long as the penultimate antennal segment (Fig. 1); occipital carina incomplete (Fig. 4); discs of abdominal tergites almost void of erect hairs, those present are short, black, sparse and inconspicuous; digitus of male genitalia not more than one third the length of distal, saddle-shaped portion of aedeagus (Fig. 16).

Abdominal Color Patterns.—as in Figs. 34, 37, 40.

Facial Color Pattern.—as in Fig. 76.

Distribution

Map 5

This Nearctic species is restricted almost entirely to the Transition and Upper Austral zones of eastern North America.

Specimens have been examined from the following localities:—

Canada.—*Nova Scotia*. *New Brunswick*: Painsec. *Ontario*: Chatham; Fisher Glen; Hornings Mills; Marmora; Port Rowan; Simcoe; Toronto.

United States.—*Maine*: Andrews Island; Rockland; South Port. *New Hampshire*: North Conway. *Massachusetts*: Amherst; Blue Hills Reserve; Boston; Buzzards Bay; Cambridge; Dover; Forest Hills; Glencarlyn; Holden; Holliston; Hopkinton; Lexington; Medford; Milton; Newton; Petersham; Plymouth Co.; Provincetown; Sagamore; Springfield; Taunton; Tyngsboro; Wellesly; Westwood. *Connecticut*: Chapinville; Colebrook; Pleasant Valley, Litchfield Co.; Stamford; Winnipauk. *Rhode Island*: Providence. *New York*: Brooklyn; Fort Montgomery; Hillburn; Ithaca; Lockport; Long Island (Bay Shore, Central Park, Huntington, Jamaica, Merrick, Montauk, Queens, Wyandanch); New Baltimore; New Paltz; New York; Staten Island; Riverhead Lake. *New Jersey*: Alpine; Barrington; Bear Swamp; Chatsworth; Fulson; Gloucester Co.; Lakehurst; Malaga; Moorestown; Overbrook; Palisades; Ramsey; Riverton; Trenton; Weymouth. *Pennsylvania*: Allen Seeger Forest, Lewistown; Carlisle; Craigheads; Darby; Enola; Harrisburg; Lehigh Gap; Philadelphia; Pittsburgh; Pocono Lake; Rock View; White Mills, Wayne Co. *Maryland*: Arundel; Edgewood; Indian Head; Laurel; Plummerville. *District of Columbia*: Washington. *West Virginia*: Berkeley Spring; Baileysville; Lost River State Park. *Virginia*: Difficult Run; Dixie Lodge; Falls Church; Nelson Co.; Rosslyn; Vienna; Wiehle. *North Carolina*: Black Mountain; Valley of Black Mountains. *Georgia*: Macon. *Michigan*: Cheyboygan Co.; Douglas Lake; Gladwin Co.; Mainstee Co.; Midland Co.; Mud Lake. *Ohio*: Hocking Co. *Indiana*. *Wisconsin*: Black River Falls; Colfax; Cranmoor; Dane Co.; Douglas Co.; Hartland; Madison; Monroe; Trout Lake; Wood Co. *Minnesota*: Alexandria; Anoka Co.; Ashby; Bemidji; Cass Co.; Chisago Co.; Hennepin Co.; Hubbard Co.; Itasca; Lake City; Lake Vадnais; Minneapolis; Norman Co.; Olmstead Co.; Parkdale; Pillager; Pine Co.; Red Lake Co.; Republic; Sebeka; Sibley Co.; St. Anthony Park; St. Paul; Viking; Wall Lake; Yellow Medicine Co. *Illinois*: Chicago; Lake Forest. *Iowa*: Delaware Co.; Page Co.; Robinson. *North Dakota*: Traill Co.

Discussion

Miller (1958) demonstrated why this entity deserves specific recognition. Like its close relatives *V. acadica*, *V. atropilosa*, *V. intermedia* and *V. consobrina* it is easily recognized over its entire range. In fact it is even structurally different from these forms.

The author continues to recognize it as a good species.

Ecological Notes.—The nest of this species is reported as being terrestrial.

Key to Species of Subgenus *Dolichovespula*

1. Pale markings yellow..... 2
Pale markings white..... 3
2. Yellow of first and second abdominal tergites deeply incised or interrupted medially; yellow hind margin of the pronotum usually produced downward along anterior, vertical carina; yellow of the postgenae continuous throughout (Figs. 20, 58, 61, 64, 82, Map 12 and 13)..... *Vespula arenaria* (Fabricius).
Yellow of first and second abdominal tergites not incised or interrupted medially; yellow hind margin of the pronotum little or not produced downward along anterior vertical carina; postgenae mostly black (Figs. 19, 60, 63, 65, 83, Map 14)..... *Vespula norvegicoides* (Sladen).
3. First and almost always the second abdominal tergite entirely black; lower half of sides of the pronotum and lower half of propodeum transversely striate (Figs. 66, 67, 68, Map 15)..... *Vespula maculata* (Linnaeus).
First and second abdominal tergites always with white markings, lower half of sides of the pronotum and propodeum punctate..... 4
4. Neuters present; occipital carina well defined; white hind margin of the pronotum narrowed anteriorly, not produced downward along anterior, vertical carina; white fasciae of the first and second abdominal tergites continuous and wide throughout, second abdominal tergite of male and worker with reddish markings (Figs. 51, 54, 57, Map 10)..... *Vespula albida* (Sladen).
Neuters absent; occipital carina poorly defined or lacking; white hind margin of the pronotum widened anteriorly, usually partially produced downward along anterior, vertical carina; white fasciae of the first and second abdominal tergites either very wide and not or little incised medially, or narrow and broadly interrupted or even absent on the first; never with reddish markings (Figs. 59, 62, Map 11)..... *Vespula arctica* Rohwer.

12. *Vespula albida* (Sladen), New Status

Vespa marginata Kirby, 1857. Fauna Bor.-Amer., v. 4, p. 265. ♀. Preocc.

Vespa albida Sladen, 1918. Ottawa Nat. 32: 71. ♂, ♀.

Vespula norvegica var. *albida* (Sladen), Bequaert, 1935. Bul. Brook. Ent. Soc. 30: 122.

Vespula albida (Sladen), Miller, 1958. Proc. Tenth International Cong. Ent., Montreal, 1: 257-264.

Diagnostic Characters

Color.—Black with white and reddish markings.

Structure.—Malar space more than half as long as the penultimate antennal segment (Fig. 2); occipital carina well defined; last five flagellar segments of male with a single tyloide near their bases (Fig. 11); digitus of male genitalia broad and truncate distally, extending well beyond apex of aedeagus but not nearly reaching pointed apex of parameral spine (Fig. 19).

Abdominal Color Patterns.—as in Figs. 51, 54, 57.

Facial Color Pattern.—as in Fig. 80.

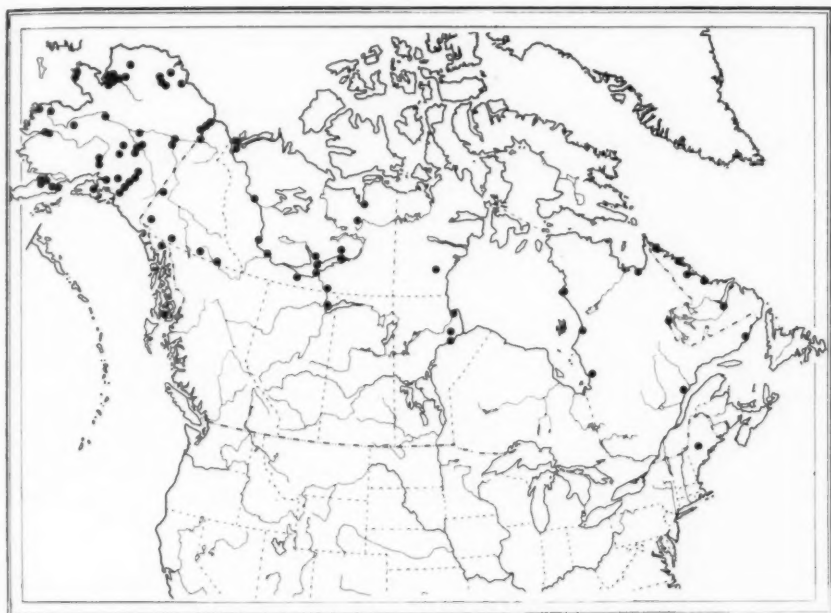
Distribution

Map 10

This Nearctic species is restricted almost entirely to the Hudsonian zone of the North American Boreal Region.

Specimens of this species have been examined from the following localities:—

Canada.—*Newfoundland*: Caribou Island; Goose Bay; Hopedale; Nain; Rama. *Quebec*: east coast of James Bay; Forestville; Fort Chimo; Great Whale River; Harrington; Knob Lake; Port Harrison; Richmond Gulf, Hudson Bay. 56°16' North, 76°24' West. *Manitoba*: Churchill; Gillam; Herchmer. *Alberta*: Fort Chipewyan. *British Columbia*: Chilkat Pass, Mile 75, 3,000 feet. *Northwest Territories*: Bathurst Inlet; Cameron Bay, Great Bear Lake; Coppermine; Fort Simpson; Fort Smith; Fort Wrigley; Great Slave Lake Region; Hardesty Island;

Map 10. Distribution of *Vespa alba* (Sladen)

Hay River; Kidluit Bay, Richards Island; Muskox Lake; Norman Wells; Outpost Island; Padlei; Reindeer Depot; Resolution; Salmita Mines; Saw Mill Bay; Yellowknife. *Yukon Territory*: Burwash Landing; Dry Creek; Rampart House; Rancheria, Swift River; Watson Lake; Whitehorse.

United States.—*Maine*: Station F. Mount Katahdin. *Alaska*: Anaktuouk Pass, 68°20' North; Annette Island; Buckland River; Camp 334, Alaskan English Commission; Cape Blossom, Kotzebue Sound; Chandler River, 69°10' North 151°35' West; College; Cooper Landing, Kenai Peninsula; Curry, 2,000 feet; Fairbanks; Firth to Latitude 69°; Fort Yukon; Golovnin; Gulkana; Haystack Mountain; Eschschotz Peninsula; Healy; International Boundary of Alaska, 69°20' North, 141° West; Katmai; Kiana, Kobuk River; King Salmon; Kodiak; Kotzebue; Kowak River, Kotzebue Sound; Kukak Bay; Kutlick, 62°30' North, 160° West; Longitude 141° West, Latitude 69°10' North; Longitude 141° West, Latitude 69°20' North; Longitude 141° West, Latitude 69°20' North; Longitude 151°30' West, Latitude 68°20' North; Lower Yukon; Matanuska; Mile 126, Glenn Highway; Miles 213, 242 and 249, Richardson Highway; Mount McKinley National Park; Naknek; Nebesna; Nome; Noorvik; Rampart House; Savonoski, Naknek Lake; Summer Creek; Summit Lake; Teller; Tolka Creek; Umiat; Umiat Mountain, Colville River; Yukon River.

Discussion

Miller (1958) demonstrated why this entity deserves specific recognition. It maintains its identity over its entire range which is almost completely sympatric with its closest relative *Vespa norvegicoides* (Sladen). The author continues to recognize it as a good species.

Lectotype.—Here designated, ♂, Nome, Alaska, Aug. 24-25, 1916. F.S.

2077, type number 6822, Canadian National Collection.

Ecological Notes.—The few nests that have been found of this species were terrestrial.

13. *Vespula arctica* Rohwer, New Status

Vespa borealis Lewis, 1897. Amer. Ent. Soc. Trans. 24: 171. ♂, ♀. Preocc.

Vespula arctica Rohwer, 1916. Conn. State Geol. and Nat. Hist. Survey Bul. 22: 642. N. name.

Vespula adulterina (Buysson), Bequaert, 1931. Ent. Amer. (n.s.) 12: 83, 84, 85, 121-125. (Nearctic records only). ♂, ♀.

Vespula adulterina var. *arctica* Rohwer, Bequaert, 1931. Ent. Amer. (n.s.) 12: 83, 84, 85, 126.

Diagnostic Characters

Color.—Black with white markings. In the Cordilleran region of North America the pale markings on some specimens are yellowish and well developed.

Structure.—Malar space more than half as long as the penultimate antennal segment (Fig. 2); occipital carina poorly defined or lacking; anterior truncate margin of clypeus of female much projecting, with prominent raised lateral angles; only the apical flagellar segment of male with a tyloide; digitus of male genitalia not extending beyond apex of aedeagus (Fig. 21).

Abdominal Color Patterns.—as in Figs. 59, 62.

Facial Color Pattern.—as in Fig. 81.

Distribution

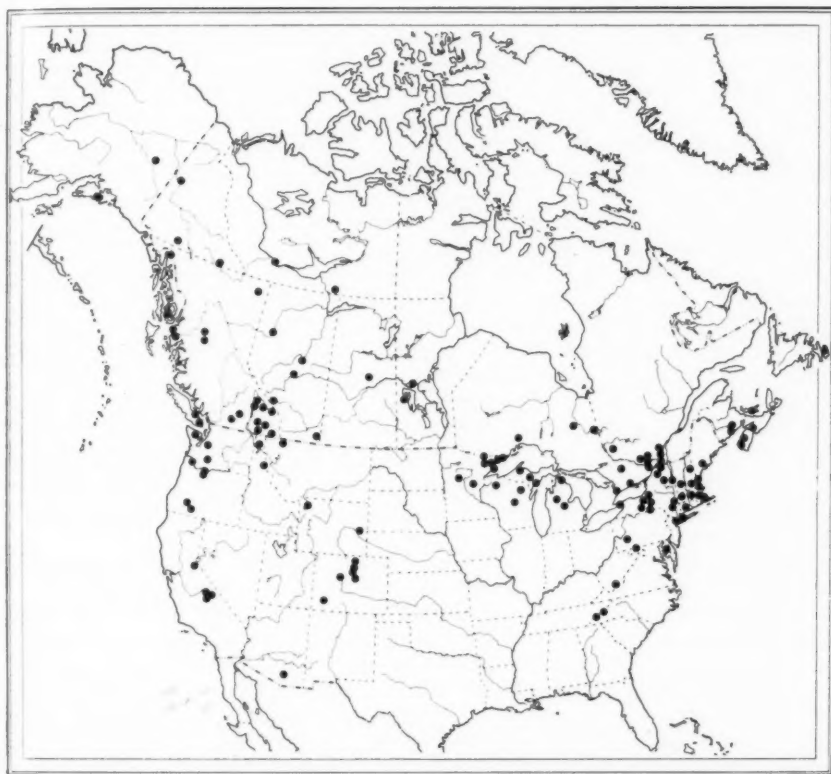
Map 11

This species is transcontinentally distributed throughout the Boreal region of North America where it is an obligatory parasite of *V. arenaria*.

Specimens of this species have been examined from the following localities:—

Canada.—*Newfoundland*: St. John's. *Nova Scotia*: Digby; Kentville; Smith's Cove. *Prince Edward Island*: Hampton. *New Brunswick*: Nerepis; St. John. *Quebec*: Cascades; Covey Hill; Fort Coulonge; Ironside; Laniel; Montreal; Val Morin. *Ontario*: Algonquin Park; Kapuskasing; Lowbush; Macdiarmid; Marmora; Niagara Glen; Ottawa; Smoky Falls; Toronto. *Manitoba*: Birch River; Cedar Lake. *Saskatchewan*: Waskesiu Lake. *Alberta*: Banff; Cypress Hills; Peace River; Wabamun. *British Columbia*: Alexis Creek; Aspen Grove; Buckley Valley; Chilcotin; Downie Creek; Fitzgerald; Fort Nelson; Fort Steele; Glacier; Groundhog Basin, Selkirk Mountains; Inverness; Kalso; Kootney National Park, 4,950 feet; Revelstoke Mountain, 6,000 feet; Robson; Royal Oak; Smithers; Vernon; Victoria. *Northwest Territories*: Fort Norman; Fort Simpson; Fort Smith. *Yukon Territory*: Dawson; Watson Lake; Whitehorse.

United States.—*Maine*: Lunksoos River; Paris. *New Hampshire*: Claremont; Durham; Ossipee; White Mountains. *Vermont*: Ascutney Mountain; Fish Creek. *Massachusetts*: Amherst; Brookline; Dover; Forest Hills; Framingham; Mount Greylock; Wellesley; Winchendon; Woods Hole; Worcester. *Connecticut*: Colebrook; Cornwall. *New York*: Canton; Catskill Mountains (Big Indian Valley, Olivera); Cortland Co.; Ithaca; Keene Valley, Essex Co.; Long Lake; Minetto; Newfield; Oswego; Ringwood; Sea Cliff; Southfields; Sterling; Taughanick. *Pennsylvania*: Pittsburgh. *New Jersey*: Palisades. *Maryland*: Frostburg. *West Virginia*: Cranberry Glades. *North Carolina*: Mount Mitchell, Valley of Black Mountains. *Michigan*: Baraga Co.; Cheboygan Co.; Dickinson Co.; Douglas Lake; Gratiot Co.; Menominee Co.; Osceola Co. *Tennessee*: Gatlinburg, 5,600 feet.

Map 11. Distribution of *Vespula arctica* Rohwer

Wisconsin: Forest Co.; Rib Mountain State Park; Sawyer Co. **Minnesota:** Cooks Co.; Cramer; Finland; Garrison; International Falls; Itasca Park; St. Louis Co. **Wyoming:** Douglas; Yellowstone National Park. **Colorado:** Boulder Co.; Chimney Gulch, Golden; Larimer Co.; Mount Manitou; Peaceful; Telluride, 11,000 feet. **Idaho:** Beaver Canyon; Priest Lake. **Arizona:** Tucson. **Washington:** Mount Adams; Mount Rainier; Olympic Mountains. **Oregon:** Clatskanie; Crater Lake Park; Eagle Ridge, Klamath Lake; Hood River; Mount Hood, 6,000 feet. **California:** Alta Meadow; Echo Lake, 7,400 feet; Inyo Co.; Giant Forest, Sequoia National Park. **Alaska:** Big Delta; Metlakatla; Seward.

Discussion

This species though relatively stable produces a variant which is more common in the western and southwestern part of its range. The variant is recognized by a widening and yellowing of the white markings. Bequaert speculated that this entity was the species *Vespula adulterina* (Buysson) which is Palearctic. Since there is no geographic connection between the two populations, the recognition of them as the same species is hypothetical.

Ecological Notes.—This species does not construct its own nest. The queen enters the nest of *V. arenaria*, reputedly destroys its queen and lays her own eggs which are reared by workers of the host. It does not produce a neuter form.

14. *Vespula arenaria* (Fabricius)

Vespa arenaria Fabricius, 1775. Systema Ent., p. 365.

Vespa borealis Kirby, 1837. Fauna Bor.-Amer., v. 4, p. 264. Preocc.

Vespa diabolica Saussure, 1854. Etudes sur la famille des Vespides, v. 2, p. 138.

♀, ♂.

Vespa fernaldi Lewis, 1897. Amer. Ent. Soc. Trans. 24: 171. ♀, ♂.

Vespula arenaria var. *fernaldi* (Lewis), Bequaert, 1931. Ent. Amer. (n.s.) 12: 116.

♂, ♀.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space more than half as long as the penultimate antennal segment (Fig. 2); occipital carina well defined; last six flagellar segments of male each with two tyloides, one near the base and one near the apex; digitus of male genitalia long and tapered distally, extending well beyond apex of aedeagus and reaching the pointed apex of the parameral spine (Fig. 20).

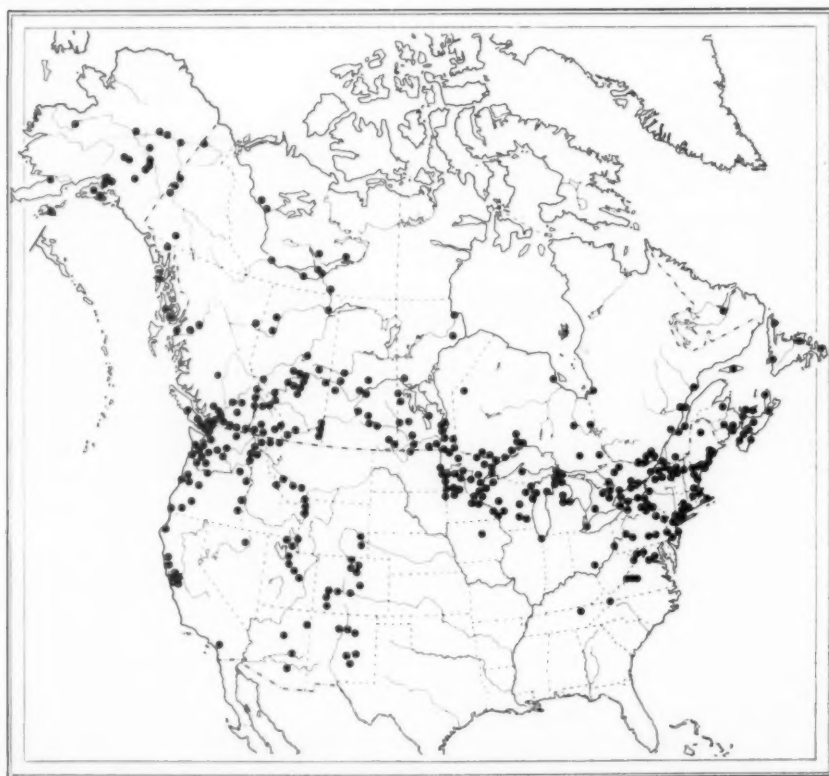
Abdominal Color Patterns.—as in Figs. 58, 61, 64.

Facial Color Pattern.—as in Fig. 82.

Distribution

Map 12 and 13

This is one of the commonest wasps in North America. It is transcontinentally distributed in the Boreal Region.



Map 12. Distribution of typical form of *Vespula arenaria* (Fab.)

Specimens of this species have been examined from the following localities:—

Canada.—*Newfoundland*: Gander; Goose Bay; Hopewell; Sprucebrook; St. Anthony. *Nova Scotia*: Baddeck; Berwick; Bridgetown; Brierly Brook; Cheticampe; Petite Rivière; Smith's Cove; Truro; Weymouth. *Prince Edward Island*: Brackley Beach; Dalvay House. *New Brunswick*: Fredericton; Halcomb; Nerepis; Painsec; St. John. *Quebec*: Aylmer; Duchesnay; Ellis Bay; Anticosti Island; Fort Coulonge; Godbout; Hemmingford; Hull; Kazabazua; Knowlton; Levis; Masham Mills; Montreal; Rupert House; Saguenay River; St. Anne de la Pocatiere. *Ontario*: Attawapiskat; Belleville; Biscotasing; Cache Lake; Clayne; De Grassi Point; Favourable Lake; Fort William; Guelph; Kapuskasing; Lake Nipigon; London; Low Bush; Marmora; Midland; Ottawa; Point Pelee; Port Sydney; Rat Portage; Red Rock; Saliness; Spencerville; Smoky Falls; Timagami; Toronto; Tosoronto; Trenton; Vineland; Wilcox. *Manitoba*: Aweme; Birch River; Brandon; Cedar Lake; Churchill; Herchmer; Husavik; Keld; Le Pas; Morden; Mulvihill; Prairie Grove; Red Deer River; Russell; Stonewall; Teulon; Winnipeg; Winkler; White-shell. *Saskatchewan*: Attens Lake; Carlisle; Edam; Fairholme; Indian Head; Last Mountain Lake; Pelly; Regina; Saskatoon; Sipton; St. Louis; Waskesiu Lake; Wenocha. *Alberta*: Athabaska; Athabaska River; Banff; Blackfoot Hills; Calgary; Cooking Lake; Cypress Hills; Edmonton; Elkwater Park; Fort Chipewain; Gull Lake; Innisfail; Jasper; Lacombe; Lethbridge; Long Rapids; Medicine Hat; Medicine Lake; Moraine Lake; Nordegg; Notikewin River; Peace River; St. Paul; Wabamun; Waterton; Wetaskiwin. *British Columbia*: Beaver Mouth; Blueberry; Bonaccord; Chilcotin; Clayburn; Chilkat Pass; Cowichan Bay; Cranbrook; Deroche; Downie Creek; Fitzgerald; Fort Steele; Groundhog Basin, Big Bend Country; Glacier; Garibaldi Park, 1,100 feet; Hazelton; Honey; Inverness; Kalso; Kamloops; Keremeos; Kicking Horse Pass; Lake Christina; Manning Park; Mission City; Moose Lake; Mount Revelstoke, 5,400 feet; Oliver; Pacific; Robson; Salmon Arm; Skagit Valley; Squamish, 3,200-4,000 feet; Sydney; Taylor; Terrace; Ucluelet; Vancouver; Vernon; Victoria. *Northwest Territories*: Fort Norman; Fort Simpson; Fort Smith; Hay River; McLeod Bay; Norman Wells; Resdelta; Resolution; Yellowknife. *Yukon Territory*: Dawson; Dry Creek; Rampart House; Snag; Whitehorse.

United States.—*Maine*: Boothbay; Cape Rosier; Casco; Mount Katahdin; Monmouth; Norway; Oldtown; Orono; South West Harbour; Squirrel Island; Waldoboro. *New Hampshire*: Durham; North Conway; Olstead; Ossipee; Pelham; Shelburn. *Vermont*: Fairlee Lake; Grand Isle; Rutland; Stowe; Woodstock. *Massachusetts*: Blue Hills Reserve; Boston; Cambridge; Dennisport; Dorchester; Forest Hills; Framingham; Holden; Marshfield; Milton; North Reading; Norwood; Petersham; Princeton; Sagamore Beach; South Natick; Tyngsboro; Wellesley; Woods Hole; Worcester. *Connecticut*: Colebrook; Lyme; Pleasant Valley, Litchfield Co.; South Windsor; Stamford. *Rhode Island*: Providence. *New York*: Ontario Mountain, Greene Co.; Benson Mines; Big Indian Valley; Catskill Mountains; Clyde; Croton Falls; Chrystal Lake; Essex Co. (Keene Valley, Upper Ausable Lake); Fort Montgomery; Freevale; Geneva; Ithaca; Keeseville; Lake George; Little Cedar Pond; Long Island; McLean; Middleport; Minetto; Mount Marcy; Newfield; New Russia; New York; Nyack; North Fairhaven; Norton's Landing; Oliveria; Oswego; Pulaski; Rochester; Sea Cliff; Southfields; Taughanick Falls; West Danby; West Point. *Pennsylvania*: Craigheads; Highspire; Legonier; Lehigh Gap; Philadelphia; Pike Co.; Pittsburgh; Roxborough; Springbrook. *New Jersey*: Burrsville; Englewood; Greenwood Lake; Lakehurst; Moorestown; Ramsey; Riverton. *Maryland*: Plummers Island. *District of Columbia*: Washington.

Virginia: Falls Church; Glencarlyn; Hot Springs; Lewinsville; Nelson Co.; Peaks of Otter, 3,000 feet; Vienna; Wingina. *West Virginia*: Lost River State Park, Hardy Co.; Millville. *Michigan*: Baraga Co.; Bay Co.; Cheboygan Co.; Clare Co.; Daggett; Detroit; Douglas Lake; Emmet Co.; Leelanaw Co.; Midland Co.; Mullet Lake. *Ohio*: Hocking Co.; Steubenville. *Tennessee*: Burrville; Laurel Bloomery. *Wisconsin*: Alma Center; Cramoor; Dane Co.; Door Co.; Goodman; Madison; Milwaukee; Osseo; Reedsville; Sawyer Co.; Wasau Lake; Wood Co. *Illinois*: Chicago. *Minnesota*: Alexandria; Barnum; Basswood Lake; Battle Lake; Beltrami Co.; Carver Co.; Cass Lake; Chisago Co.; Clearwater Lake; Cook Co.; Deep Haven; Detroit Lakes; Fergus Falls; Finland; Garrison; International Falls; Itasca; Kawis-hiwi River; Koochiching Co.; Lake Co.; Lake Lena; Lake Sup.; Lancaster; Lamoille; La Porte; Le Sueur Co.; Maknomen; Meadowlands; Middle River; Mille Lacs; Minneapolis; Moorehead; Newport; Norman Co.; Olmstead Co.; Ottawa; Pine City; Ramsey Co.; Republic; Rochester; Roseau Co.; Sedan; Shevlin; St. Anthony's Park; St. Paul; St. Peter; Todd Co.; Two Harbours; Vineland; Washington Co.; Willow River. *Iowa*: Ames. *North Dakota*: Fargo; Grand Forks; Lake Metagoshie. *Montana*: Bozeman; Como Lake; Glacier National Park (Logan Pass, Saint Mary's Peak, Two Medicine Lake); Skalkaho Pass; Troy; Whiteshell. *Idaho*: Beaver Canyon; Lewiston; Moscow; Pierce; Priest Lake. *Wyoming*: Douglas; Grand Teton National Park; Jackson; Platt Co.; Yellowstone National Park (Madison Junction; Sylvan Pass). *Utah*: Beaver Creek, Cache Co.; Emery Co.; Logan; Logan Canyon; Payson; Salt Lake City; Uintah National Forest. *Colorado*: Bayfield, 9,000 feet; Black Canyon, Cimarron; Boulder; Boulder Co.; Clear Creek, Jefferson Co., 6,500 feet; Colorado Springs; Denver; Estes Park; Gregory Canyon; Golden; Harry Creek, Marshal Pass, 9,000 feet; Manitou Park; Pikes Peak; Platte Canyon, Silverton; West Cliff. *New Mexico*: Beulah; Cloudcroft; Jemez Springs; Las Vegas; Ruidoso; Santa Fe, 9,200 feet; Eagle Creek, White Mountains, 8,000 feet. *Arizona*: Alpine; Globe; Mount Lemon; Oak Creek Canyon, 6,000 feet. *Washington*: Colokum Pass; Copalis; Index; Leavenworth; Liberty; Lucerne; McLeary; Mount Adams; Mount Rainier, 4,500 feet; Naches River; Nasel River, Nehcotta; New Port; Olympia; Orcas Island; Packwood; Pluvius; Pullman; Republic; San Juan Island; Skamokawd; Spokane; Table Rock Mountain; Wenatchee. *Oregon*: Crater Lake; Corvallis; Detroit; Florence; Galioe, Rogue River; Gold Beach; Mahogany Mountain, Malheur Co.; Mary's Peak; Mount Hood; Ontario; Summit, Benton Co., 650 feet; Union Co.; Wallowa Lake, 5,000 feet. *Nevada*. *California*: Alameda Co.; Benicia; Berkeley; Cazadero; Eureka; Messa Grande, Sonoma Co.; Redlands; San Francisco; San Mateo Co.; Santa Clara Co.; Stanford University. *Alaska*: Anchorage; Bear Lake; Beaver; Big Delta; Cooper Landing; Donnelly Dome, Mile 249, Richardson Highway; Eklutna Lake; Fairbanks; Fort Richardson; Fort Yukon; Healy; Junction of Bonasita and Yukon Rivers; Kadiak; Ketchikan; King Salmon; Matanuska; Metlakatla; McKinley Park; Moose Pass; Mouth of Dall River; Seward; Shaw Creek; Sitka; Skagway; Tanana.

A variant is produced by this species which is distinguishable from the typical form by the appearance of a yellow spot pinpoint to several millimeters in size on each side of the propodeum. Though sporadic throughout the population the incidence of occurrence of this variant increases in the southwest where the abdominal markings are accompanied by a widening of the fasciae of the abdominal tergites.

Specimens of this variant have been examined from the following localities:—

Canada.—*Newfoundland*: Sprucebrook. *Nova Scotia*: King's Co. *Prince Edward Island*: Brackley Beach. *Quebec*: Hemmingford. *Ontario*: Chatham;



Map 13. Distribution of xanthic variant of *Vespula arenaria* (Fab.).

Gull Lake; Lake Nipigon; Lake Wilcox; Macdiarmid; Marmora; North Bay; Ottawa; Singhampton; Sioux Narrows; Strathroy; Streetsville; Toronto; Vineland. *Manitoba*: Rennie; Whiteshell; Winnipeg. *Alberta*: Banff; Cowley; Innisfail; Lethbridge; Medicine Hat; Nordegg; Vermilion. *British Columbia*: Bear Canyon; Cranbrook; Downie Creek; Fort Steele; Groundhog Basin; Big Bend Country; Hazelton; Kamloops; Kalso; Lillooet; Mount Revelstoke; Robson; Royal Oak; Salmon Arm; Vancouver; Vernon. *Northwest Territories*: Fort Smith. *Yukon Territory*: Watson Lake.

United States.—*Maine*: Orono. *Massachusetts*: Boston; Cambridge. *Connecticut*: Colebrook. *New York*: Caroline-Harford; Ithaca; Labrador Lake. *Pennsylvania*: Springbrook; Harrisburg. *New Jersey*: Evesboro. *Maryland*: Bowie. *District of Columbia*: Washington. *Michigan*: La Peer Co.; Midland Co.; Mullet Lake. *Minnesota*: Anoka Co.; Ely; Hennepin Co.; Itasca Park; Lake Itasca; Milaca; Ottawa; Shevlin; St. Anthony's Park; Two Harbours; Warroad. *South Dakota*: Rapid City. *Montana*: Missoula; Skalkaho Pass. *Colorado*: Bayfield, 9,000 feet; Black Canyon, Cimarron; Chimney Gulch, Golden; Clear Creek; Denver; Eldora; Elk Creek; Estes Park; Fraser, Grand Co.; Glen Haven; Gold Hill; Los Pinos; Mount Manitou, 9,000 feet; Ohio; Pagosa Peak; Pikes Peak; Pinecliffe; Pinegree Park; Rand; Tolland, Gilpin Co.; Ward. *New Mexico*: Beulah; Closson; Jemez Springs; Truchas Mountains, Sangre de Cristo Range. *Idaho*: Moscow;

Moscow Mountain; Priest Lake; Wallace. *Utah*: Buckskin Valley; Beaver Range Mountains, 9,000 feet; Emery Co.; Hanna; Kegalis Ranger Station, La Sal National Park; Logan; Park City; Salt Lake City; Uintah Mountains, 8,000 feet. *Arizona*: Flagstaff; Grand Canyon; Mount Lemon, 8,000 feet; Oak Creek Canyon; San Francisco Mountains; White Mountains. *Washington*: American River; Battle Ground, Clark Co.; Blue Mountains; Chinook Pass; Colokum Pass; Liberty; Mount Adam; Mount Rainier; Ocean Park; Olympia; Orcas Island; Packwood; Pullman; Tablerock Mountain. *Oregon*: Anthony Lake; Corvallis; Mount Hood; Rainier. *Nevada*: Elko. *California*: Alta Meadow, 8,000 feet; Alta Mesa; Berkeley; Big Sur River; Bishop; Chester; Devil's Post Pile; Dyerville; Eureka; Felton, Santa Cruz Mountains, 400 feet; Klamath; Lake Tahoe; Mesa Grande, Sonoma Co.; Miles; Mission San Jose, Alameda Co.; Monterey; Pacific Grove; Palo Alta; Pepper Wood, Eel River, Humboldt Co.; San Francisco; Tulare Co. [Coyote Creek, Sequoia National Park (Cahoon Meadow, 8,000 feet, Giant Forest, 6,500 feet, Hockett Meadow, Shotgun Creek)]; Upper Santa Anna River, San Bernardino Co.; Winters; Yosemite.

Discussion

An xanthic variant produced by this species is not as Bequaert said "rare" in eastern North America. Its incidence of occurrence does become greater in western North America but it is still anything but dominant there. It reputedly has been taken from nests containing the typical form, and the author certainly has seen every conceivable intergradation between it and the typical form.

Ecological Notes.—The nest of this species is aerial. It often builds under the eaves of homes where it becomes a domestic pest.

15. *Vespa norvegicoides* (Sladen), New Status

Vespa norvegicoides Sladen, 1918. Ottawa Nat. 32: 71. ♂, ♀.

Vespa norvegica var. *norvegicoides* (Sladen), Bequaert, 1931. Ent. Amer. (n.s.) 12: 83, 85, 118. ♂, ♀, ♀.

Vespa norvegicoides (Sladen), Miller, 1958. Proc. Tenth International Cong. Ent., Montreal, 1: 257-264.

Diagnostic Characters

Color.—Black with yellow markings.

Structure.—Malar space more than half as long as the penultimate antennal segment (Fig. 2); occipital carina well defined; apical six flagellar segments of male with two tyloides, one near the base and one apically; digitus of male genitalia same as *V. albida* (Fig. 19).

Abdominal Color Patterns.—as in Figs. 60, 63, 65.

Facial Color Pattern.—as in Fig. 83.

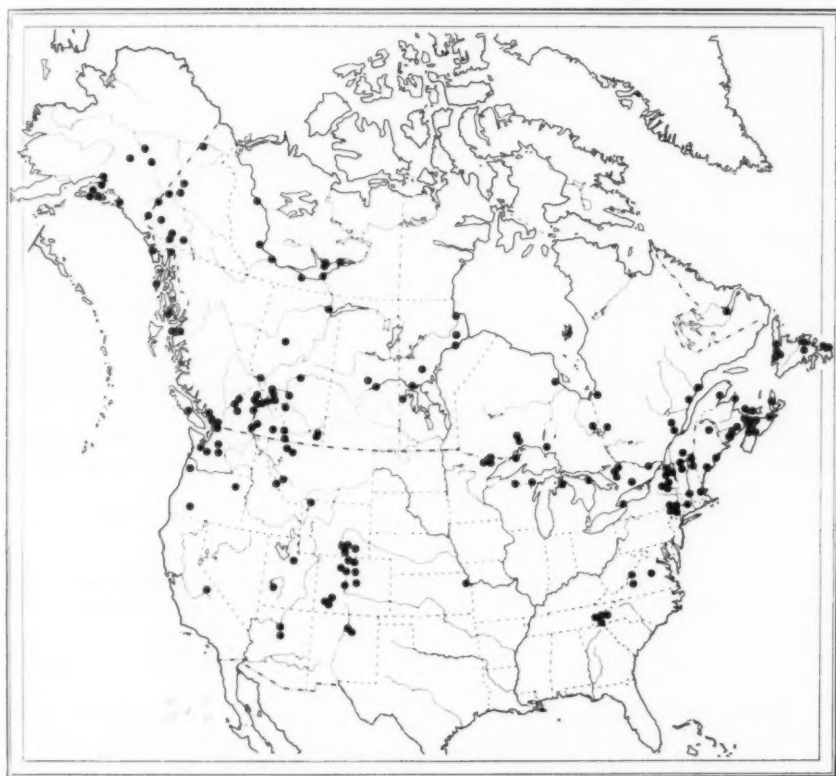
Distribution

Map 14

This Nearctic species is restricted almost entirely to the Canadian and Hudsonian zone of the Boreal region.

Specimens of this species have been examined from the following localities:—

Canada.—*Newfoundland*: Bay of Islands; Carbonear; Gander; Goose Bay; Little River; Nicholsville; Romaine Brook; Salmonier; St. John's. *Nova Scotia*: Amherst; Brierly Brook; Cape Breton Island (Borachois, Loch O'Lou); Halifax; Kentville; Truro. *Prince Edward Island*: Alberton; Dalvay House. *New Brunswick*: Nerepis; Painsec; Pokemouche; St. John. *Quebec*: Abitibi Region; Duchesnay; Forestville; Godbout; Kelly Camp, Cascopedia, Gaspé; Lac Jacques Cartier; Megantic; Rupert House. *Ontario*: Algonquin Park; Attawapiskat; Bannockburn;

Map 14. Distribution of *Vespula norvegicoides* (Sladen).

Huntsville; Lake Nipigon; Lowbush; Macdiarmid; Niagara Glen; Ottawa; Port Sydney; Tobermory; White River. *Manitoba*: Birch River; Cedar Lake; Churchill; Gillam; Herchemer; Wabowden. *Saskatchewan*: Crest; Waskesiu. *Alberta*: Banff; Cowley; Cypress Hills; Edmonton; Elkwater; Fort Chipewyan; Moraine; Jasper; Lake Louise; Lesser Slave Lake; Nordegg; Waterton. *British Columbia*: Agassiz; Chase; Field; Fort Steele; Glacier; Groundhog Basin, Big Bend Country; Hope Summit; Ille-Cillewaet; Inverness; Kaslo; Kicking Horse Pass; Mount Cheam; Mount Seymour, 4000 feet; Prince Rupert; Revelstoke; Revelstoke Mountain, 5400 feet, 5800 feet, 6000 feet, 6350 feet; Rogers Pass; Sandon; Squamish, 3200 feet; Ucluelet; Vancouver; Vernon; Yoho National Park. *Northwest Territories*: Fort Simpson; Fort Wrigley; Great Slave Lake; Gros Cap; Hardisty Island; Hay River; Norman Wells; Outpost; Resolution. *Yukon Territory*: Burwash Landing; Champagne; Dawson; Dazadeash; Dry Creek; Klutland Glacier, 9000 feet; Rampart House; Selwyn; Snag; Whitehorse.

United States.—*Maine*: Bar Harbour; Saddleback Lake, 2500 feet; Waldoboro. *New Hampshire*: Mount Washington; Shelburne. *Vermont*: Jay; Stowe. *New York*: Adirondack Mountains; Big Indian Valley, Catskill Mountains; Heart Lake; Keene Valley; Mount Marcy, 3200 feet; North Creek; Oliveria; Onteora Mountain, Greene Co.; Raquette Lake; Upper Ausable Lake, Essex Co.

Massachusetts: Petersham; Wollaston. *Connecticut*: Colebrook. *Virginia*: Bald Knob, Bath Co., 4000 feet; Peaks of Otter; Rutland. *North Carolina*: Mitchell; Highlands. *Michigan*: Dickinson Co.; Douglas Lake; Isle Royal. *Tennessee*: Clingman's Dome, Great Smoky Mountain National Park; Gatlinburg, 3000 feet. *Wisconsin*: Vilas Co. *Minnesota*: Basswood Lake; Burntside Lake; St. Louis Co. *Kansas*: Laurence. *Montana*: Como Lake; Glacier National Park (Grinnell Lake, Logan Pass); Lost Horse Canyon; Neihart. *Wyoming*: Albany Co.; Centennial; Medicine Bow Range; Stewart River Station; Yellow Stone National Park (Madison Junction, Sylvan Pass, West Thumb). *Colorado*: Boulder Co., 9500 feet; Chimney Gulch, Golden; Cornet Creek, Telluride; Creede, 8800 feet; Eldora; El Paso Co.; Glen Haven; Loveland Pass; Manitou Park; Pinegree Park; Silverton; Ward, 6500 feet. *Utah*: Mount Nebo; Wasatch Mountain. *New Mexico*: Pecos; Truchas Mountains, Sangre de Cristo Range, 9000 feet. *Arizona*: Flagstaff; San Francisco Mountains. *Washington*: Colokum Pass; Mount Baker; Mount Rainier; Olympia Mountains, 5000 feet; Rainier National Park. *Oregon*: Anthony Lake; Crater Lake Park; Forest Grove. *California*: Alta Meadow, 8000 feet. *Alaska*: Anchorage; Big Delta; Cooper Landing; Cordova; Fairbanks; Matamuska; Metlakatla, Annette Island; Moose Pass, Kenai Peninsula; Mount McKinley National Park; Seward; Sitka; Skagway; Virgins Bay.

Discussion

Miller (1958) demonstrated why this entity deserves specific recognition. It remains distinct throughout its entire range which is partially sympatric with that of *V. albida* with which it has been associated in a subspecific manner. No intergradient color patterns between the two have ever found and the males are structurally separable. The writer continues to recognize this entity as a good species.

Lectotype.—Here designated, ♀, Amherst, N.S., 11.VII.15, 2187, type number 6823, Canadian National Collection.

Biological Notes.—The nest of this species is reported as being aerial.

16. *Vespa maculata* (Linnaeus)

Vespa maculata Linnaeus, 1763. Centuria Ins. Rar., p. 30.

Vespa maculata americana Christ., 1791. Naturgesch. Insekt. Bienen, Wespen u. Ameisengeschl., p. 239.

Diagnostic characters

Color.—Black with white markings.

Structure.—Malar space more than half as long as the penultimate antennal segment (Fig. 2); lower half of the sides of the pronotum and propodeum transversely striate; male genitalia as in Fig. 22.

Abdominal Color Patterns.—as in Figs. 66, 67, 68.

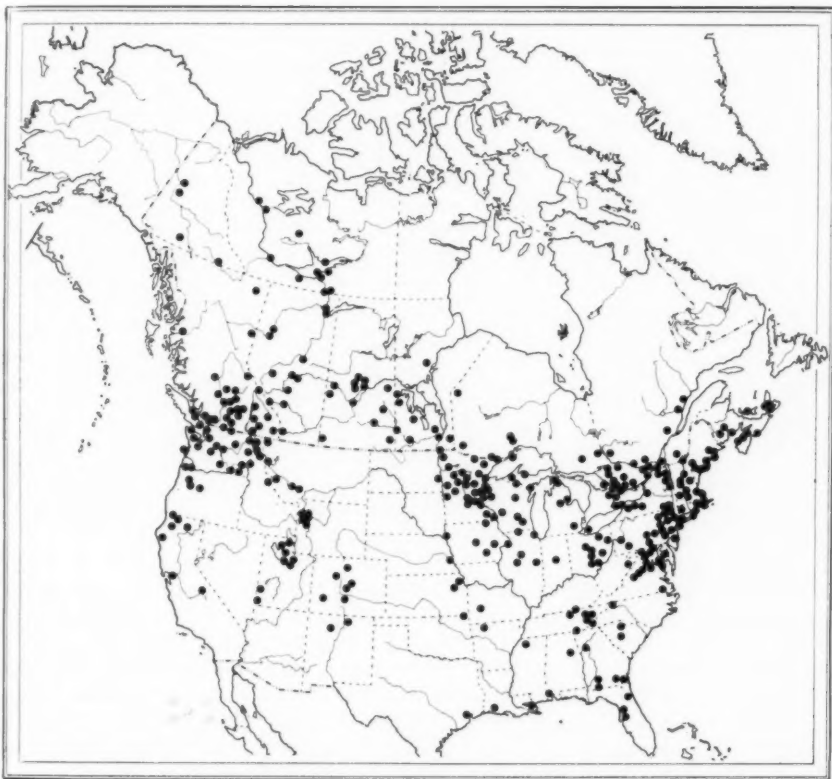
Facial Color Pattern.—as in Fig. 84.

Distribution

Map 15

This Nearctic species is more widespread and as common as *V. arenaria*. It occurs throughout the whole of the Canadian, Transition, Upper Sonoran and Upper Austral zones and in the east extends well into the Lower Austral zone.

Specimens of this species have been examined from the following localities:—*Canada*.—*Nova Scotia*: Baddeck; Bridgetown; Bucklaw; Lake George; McNab's Island, Halifax; Smith's Cove. *Prince Edward Island*: Dalvay House. *New Brunswick*: Fredericton; Nerepis; St. John. *Quebec*: Abbotsford; Covey Hill; Duchesnay; Forestville; Fort Coulonge; Lac Nominique; Laniel; Megantic;

Map 15. Distribution of *Vespula maculata* (Linné.).

Saguenay River. *Ontario*: Algonquin Park; Ballantre; Bancroft; Belleville; Biscotasing; Cache Lake; Castle Island, Lake Timagami; Credit Forks; De Grassi Point; Favourable Lake; Glen Major; Gold Rock, Rainy River District; Huntsville; Jockvale; Lake Nipigon; Macdiarmid; Marmora; Midland; Muskoka; Niagara Glen; Ottawa; Point Pelee; Port Sydney; Shakespear Island; Sioux Narrows; Spencerville; Timagami; Toronto; Vineland. *Manitoba*: Aweme; Birch River; Mafeking; McAuley; McCreary; Pikwitonei; Red Deer River; Teulon; Whiteshell; Winnipeg. *Saskatchewan*: Amsterdam; Attens Lake; Christopher Lake; Cypress Hills; Good Spirit Lake; Hudson Bay; Indian Head; Kingsmere Lake; Prince Albert; Rutland; Saskatoon; Shellbrook; Waskesiu Lake; Wenoncha. *Alberta*: Banff; Banff Springs; Calgary; Clymont; Cowley; Edmonton; Edson; Fort Chipewyan; Gull Lake; Lake Athabaska; Peace River; Racer River; Smoky River Landing. *British Columbia*: Adam's Lake; Agassiz; Aspen Grove; Chase; Chilcontin; Departure Bay; Fernie; Fort Nelson; Howser; Ille-Cillwaet; Invermere; Kamloops; Kalso; Kelowna; Keremeos; Lillooet; Moose Lake; Nanaimo; New Westminster; Oliver; Osoyoos; Pass Lake; Peter's Lake; Robson; Rolla; Royal Oak; Terrace; Trinity Valley; Vancouver; Vancouver Island; Vernon; Yellowhead Lake. *Northwest Territories*: Fort Norman; Fort Simpson; Fort Smith; Gros Cap; Hay River; Lake Sarah; Norman Wells; Resdelta; Resolution; Rocher River; Salt River. *Yukon Territory*: Dawson, 1300 feet; Selwyn; Watson Lake; Whitehorse.

United States.—*Maine*: Bar Harbour; Casco; Monmouth; Mutneville; Norway; Orono; Sebago Lake; South West Harbour; Squirrel Island; Waldoboro. *New Hampshire*: Center Harbour; Durham; Dixville Notch, 1800 feet; Nelson; North Conway; Pelham; West Swanzy; White Mountains. *Vermont*: Fairlee Lake; Woodstock. *Massachusetts*: Amherst; Cambridge; Cummington; Dorchester; Dover; Forest Hills; Framingham; Lexington; Lynn; Martha's Vineyard; Milton; Paxton; Petersham; Plymouth Co.; Princeton; Scituate; Stoney Brook Reservation; Tyngsboro; Wellesley. *Connecticut*: Bethlehem; Chapinville; Colebrook; Redding; Wallingford. *Rhode Island*: Providence. *New York*: Axton; Batavia; Big Indian Valley, Catskill Mountains; Cooks Falls; East Bethany; Essex Co. (Keene Valley, Upper Ausable Lake); Gardiner's Island; Harrison; Heart Lake; Highlands; Honeone Falls; Ithaca; Labrador Hollow; Lake George; Little Cedar Pond; Long Island (Cold Spring Harbour, Hempstead, Flushing, Jamaica, Little Neck, Wyandanch); New Russia; Oliveria; Peekskill; Roslyn; Southampton; West Point; Yorktown Heights. *Pennsylvania*: Allen Seeger Forest; Broomal; Castle Rock; Dupont; Enola; Harrisburg; Indian Creek; Le Bannion Co.; Lehigh Gap; Linglestown; Overbrook; Pike Co.; Pocono Lake; York Co. *New Jersey*: Evesboro; Lake Hurst; Moorestown; Princeton; Rancocas Park; Ramsay; Riverton. *Maryland*: Baltimore; Beltsville; Cabin John; Charles Co.; Chevy Chase Lake; East Newmarket; Glen Echo; Indian Head; Plummer's Island; Summerset Heights; T.B.; Prince Georges Co. *District of Columbia*: Washington. *Virginia*: Charlottesville; Dismal Swamp; Falls Church; Fredericksburg; Great Falls to Spring Hill; Hardscrabble Knob, Augusta Co.; Langley; Merrifield; Mount Love, Nelson Co.; Rosslyn; Rutland; Vienna; Wilson Gap, Lowden Co.; Wingina; Woodbridge. *West Virginia*: Barger's Springs, Lost River State Park, Hardy Co. *North Carolina*: Blowing Rock, 4000 feet; Highlands, 4000 feet. *South Carolina*: Batesburg; Santuck. *Georgia*: Atlanta; Kirkwood; Okefenokee Swamp; Thomson Mills. *Florida*: Georgetown; Georgia; Hilliard; Lacoochee; Monticello; Plant City; Thomasville. *Michigan*: Ann Arbor; Bay Co.; Cheboygan Co.; Emmet Co.; Isle Royal; Marquette; Menominee; Midland; Watersmeet. *Ohio*: Columbus; Fairfield Co.; Hocking Co.; Marietta; Medina; Salinville; Senacaville; Sargar Grove. *Indiana*. *Tennessee*: Black Mountains, Cumberland Co.; Burrville; Clingman's Dome, Great Smoky National Park; Elmont, 3000 feet; Gatlinburg; Knoxville. *Alabama*: Alexander City; Mobile Co. *Wisconsin*: Burnett Co.; Colfax; Dane Co.; Madison; Rib Mountain State Park; Sparta; Siren; St. Croix Falls; Vilas Co. *Minnesota*: Aitken; Alexandria; Basswood Lake; Carver Co.; Cass Co.; Cedar Creek, Chisago Co.; Cook Co.; Coon Creek; Cromwell; Dakota Co.; Garrison; Hackensack; Hennepin Co.; Houston Co.; Itasca Park; Koochiching Co.; Lake Pepin, East Frontenac; Lancaster; Maples; Marshall Co.; Olmstead Co.; Parkdale; Pillager; Pine City; Pine Co.; Plummer; Preston; Ramsey Co.; Red Wing; Sedan; Shakopee; St. Louis Co.; St. Paul; St. Peter; Todd Co.; Washington Co. *Illinois*: Chicago; Durand; Moline; Manito; Peoria; Urbana. *Iowa*: Ames; Davis Co.; Elma; Iowa City; Sioux City. *Missouri*: Willard. *Arkansas*: Marion Co. *Mississippi*: Oxford. *Louisiana*: Jennings; New Orleans. *North Dakota*: Fargo. *Nebraska*: Nebraska City. *Kansas*: Baldwin; Douglas Co. *Oklahoma*: Ottawa Co. *Texas*: Cypress Mills. *Montana*: Bozeman; Como Lake; Haugan; Lost Horse Canyon, Ravalli Co.; Whitehall. *Wyoming*: Bondurant; Grand Teton National Park; Jackson; Jackson's Hole; Jackson's Lake. *Colorado*: Boulder; Estes Park; Golden; Hensdale Co.; Longview; Manitou Park; West Cliff. *New Mexico*: Jemez Springs; Pecos National Forest. *Idaho*: Collin; Craig Mountain; Moscow; Moscow Mountain; Priest Lake; Wallace. *Utah*: Beaver Creek Hills, Beaver Co.; Beaver Creek, Logan Pass; Beaver Mountain; Beaver

River, Uintah Mountains; Bellevue, Washington Co.; Buckskin Valley; Hanna; Heber; Logan; Mouth Bear River; Provo Canyon; Salt Lake City; Uintah National Forest. *Washington*: American River; Blewet Pass; Blue Mountains, 3000 feet; Garfield Co.; Keller; Lake Crescent; Lewis Peak, Blue Mountains; Longmire; Loomis; Loon Lake; Mount Adams, 4200 feet; North Bend, King Co.; Olympia; Orcas Island; Pullman; Quinault; Seattle; Spokane; Table Rock Mountain; Usk; Walla Walla; Wenatchee; White Swan. *Oregon*: Blue Mountains, 5000 feet; Cascadia; Corvallis; Forest Grove; Lebanon; Mary's Peak; Pebble Creek; Portland; Prineville. *California*: Antioch; Carrville; Trinity Co.; Cayton, Shaston Co.; Giant Forest, Sequoia National Park; Helena; Mendocino Co.; Sisk Co.

Discussion

This is, from the writer's experience, the most stable species of *Vespula* in North America. It is very common, very widely distributed and yet produces very few variants. Those observed by the author are different from the typical form in that the white markings become very wide and almost dominate the black background color of this species. The writer has seen very few of these specimens and all have been from the south eastern part of the species range.

Ecological Notes.—The nest of this species is aerial.

References

- Bequaert, J. 1930. On the generic and subgeneric divisions of the Vespinae (Hymenoptera). *Bull. Brooklyn Ent. Soc.* 25: 59-70.
- Bequaert, J. 1931. A tentative synopsis of the hornets and yellow-jackets (Vespinae: Hymenoptera) of America. *Ent. Amer. (n.s.)* 12: 71-138.
- Bequaert, J. 1935. Additions and corrections to the revision of North American Vespinae (Entomologica Americana, 1931). *Bull. Brooklyn Ent. Soc.* 30: 119-124.
- Bequaert, J. 1941. Additions and corrections to the revision of North American Vespinae (Entomologica Americana, 1932). Second paper. *Bull. Brooklyn Ent. Soc.* 36: 111-117.
- Bohart, R. M. 1951. Superfamily Vespoidea. In Hymenoptera of America north of Mexico. Synoptic Catalog, by C. F. W. Muesebeck, K. V. Krombein, H. K. Townes, and others, pp. 875-907. *U.S. Dept. Agr., Agr. Monogr.* 2.
- Bohart, R. M. and R. C. Bechtel. 1957. The social wasps of California. *Bull. California Insect Survey* 4: 73-101.
- Duncan, C. D. 1939. A contribution to the biology of North American Vespinae wasps. *Stanford Univ. Pub., Univ. Series, Biol. Sc.* 8(1).
- Miller, C. D. F. 1958. Distributional and nomenclatorial problems in some forms of *Vespula* in North America (Hymenoptera: Vespidae). *Proc. 10th Intern. Congr. Ent., Montreal*, 1956, 1: 257-265.
- Sladen, F. W. L. 1918. The genus *Vespa* in Canada. *Ottawa Nat.* 32: 71-72.
- Tissot, A. N. and F. A. Robinson. 1954. Some unusual insect nests. *Florida Ent.* 37: 73-92.
- Wilson, E. O. and W. L. Brown. 1953. The subspecies concept and its taxonomic application. *Syst. Zool.* 2: 97-111.

(Received Oct. 5, 1960)

ILLUSTRATIONS

Figs. 1-11. Heads, metathoracic leg, terminalia, tips of fore wings, and antennal segment of *Vespula* spp. 1, 2. Lateral aspect of heads and penultimate antennal segments of species of *Vespula* and *Dolichovespula* respectively. 3, 4. Posterior aspect of right half of heads of species of *Vespula*. 5. Anterior aspect of left metathoracic leg of *Vespula austriaca* (Panzer). 6-8. Lateral aspect of terminalia of *Vespula vulgaris* (Linné) and *Vespula pennsylvanica* (Sauss.), a specimen intermediate between *Vespula vulgaris* and *Vespula maculifrons* (Buysson), and *Vespula maculifrons* respectively. 9, 10. Distal part of fore wings of *Vespula squamosa* (Drury) and *Vespula sulphurea* (Sauss.) respectively. 11. Penultimate antennal segment of male of *Vespula albida* (Sladen).

p = penultimate antennal segment, occ = occipital carina, VII T = seventh tergite, t = tyloide.

Figs. 12-22. Dorsal aspect of male genitalia of *Vespula* spp. 12. *Vespula vulgaris* (Linné.) and *Vespula maculifrons* (Buysson). 13. *Vespula pennsylvanica* (Sauss.). 14. *Vespula austriaca* (Panzer). 15. *Vespula acadica* (Sladen), *Vespula atropilosa* (Sladen), *Vespula consobrina* (Sauss.) and *Vespula intermedia* (Buysson). 16. *Vespula vidua* (Sauss.). 17. *Vespula squamosa* (Drury). 18. *Vespula sulphurea* (Sauss.). 19. *Vespula albida* (Sladen), *Vespula norvegicoides* (Sladen). 20. *Vespula arenaria* (Fab.). 21. *Vespula arctica* Rohwer. 22. *Vespula maculata* (Linné.).

aed = aedeagus, dig = digitus, f = parameral spine.

Figs. 23-31. Abdominal color patterns of *Vespula* spp. 23, 26, 29. *Vespula vulgaris* (Linné.), ♂, ♀, and ♀ respectively. 24, 27, 30. *Vespula maculifrons* (Buysson), ♂, ♀, and ♀. 25, 28, 31. *Vespula pennsylvanica* (Sauss.), ♂, ♀, and ♀.

Figs. 32-40. Abdominal color patterns of *Vespula* spp. 32, 35, 38. *Vespula atropilosa* (Sladen), ♂, ♀, and ♀ respectively. 33, 36, 39. *Vespula acadica* (Sladen), ♂, ♀, and ♀. 34, 37, 40. *Vespula vidua* (Sauss.) ♂, ♀, and ♀.

Figs. 41-48. Abdominal color patterns of *Vespula* spp. 41, 44, 47. *Vespula consobrina* (Sauss.), ♂, ♀, and ♀ respectively. 42, 45. *Vespula austriaca* (Panzer), ♂, ♀, and no ♀. 43, 46, 48. *Vespula intermedia* (Buysson), ♂, ♀, and ♀.

stippling = light and dark reddish markings.

Figs. 49-57. Abdominal color patterns of *Vespula* spp. 49, 52, 55. *Vespula squamosa* (Drury), ♂, ♀, and ♀ respectively. 50, 53, 56. *Vespula sulphurea* (Sauss.), ♂, ♀, and ♀. 51, 54, 57. *Vespula albida* (Sladen), ♂, ♀, and ♀.

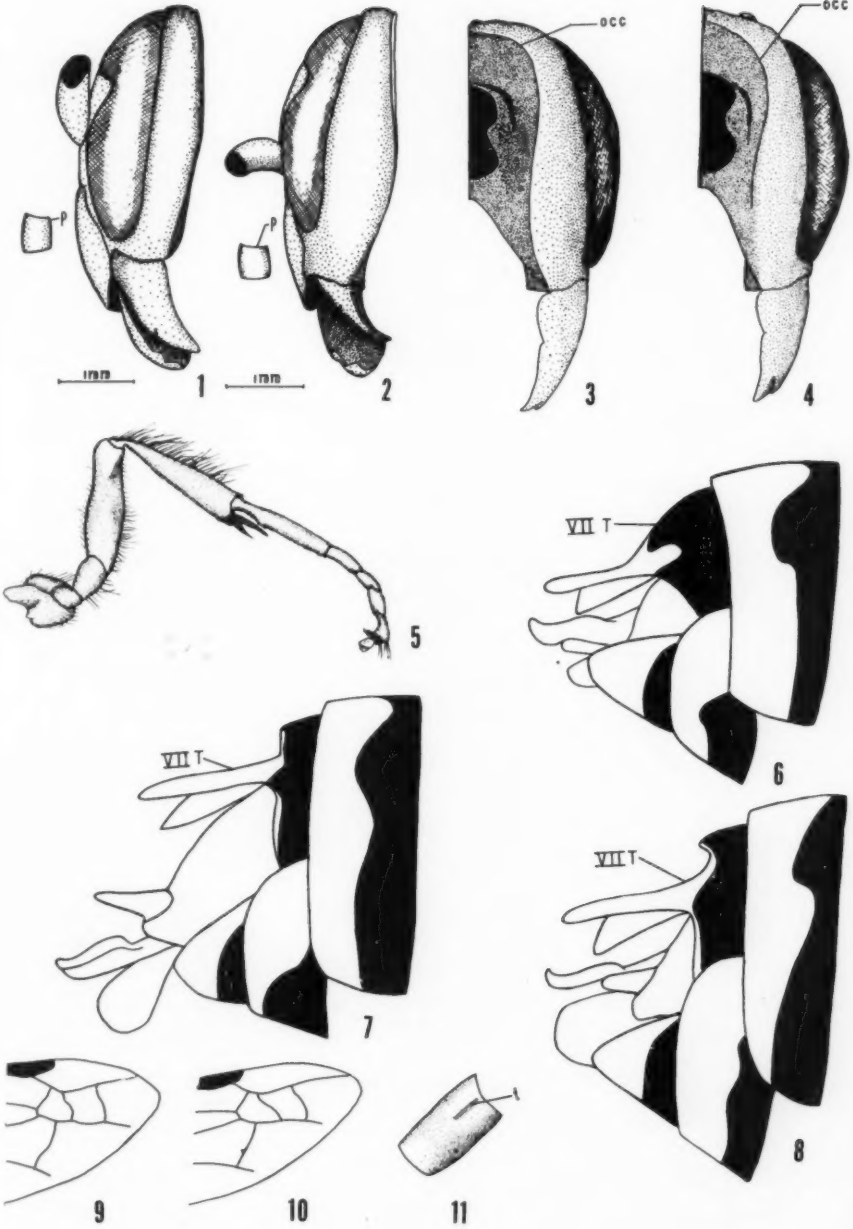
stippling = light and dark reddish markings.

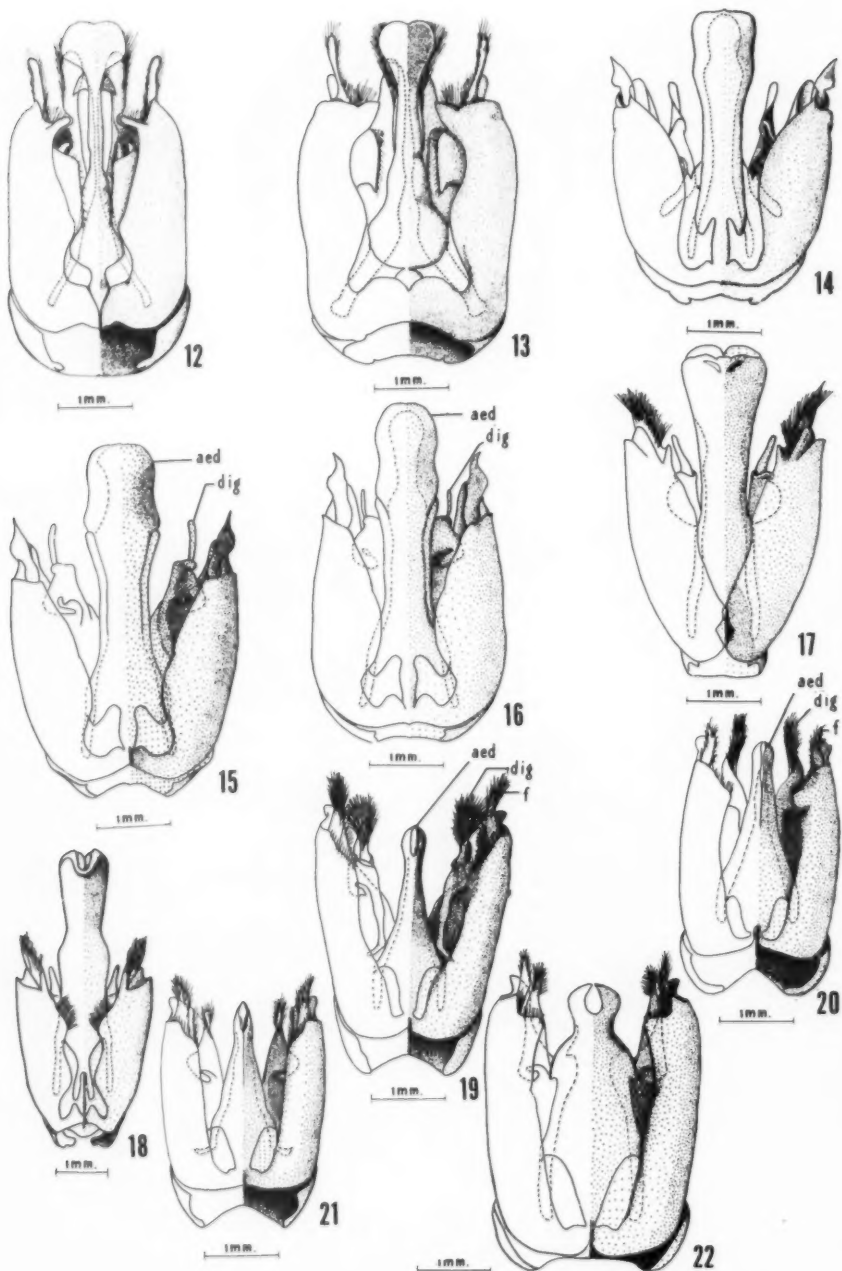
Figs. 58-65. Abdominal color patterns of *Vespula* spp. 58, 61, 64. *Vespula arenaria* (Fab.), ♂, ♀, and ♀ respectively. 59, 62. *Vespula arctica* (Rohwer), ♂, ♀, and no ♀. 60, 63, 65. *Vespula norvegicoides* (Sladen), ♂, ♀, and ♀.

Figs. 66-72. Abdominal and facial color patterns of *Vespula* spp. 66-68. Abdominal color patterns of *Vespula maculata* (Linné.), ♂, ♀, and ♀ respectively. 69-72. Facial color patterns of *Vespula vulgaris* (Linné.), ♀, *Vespula maculifrons* (Buysson), ♀, *Vespula pennsylvanica* (Sauss.), ♀, *Vespula atropilosa* (Sladen), ♀, respectively.

Figs. 73-78. Facial color patterns of *Vespula acadica* (Sladen), ♀, *Vespula consobrina* (Sauss.), ♀, *Vespula intermedia* (Buysson), ♀, *Vespula vidua* (Sauss.), ♀, *Vespula austriaca* (Panzer), ♀, *Vespula squamosa* (Drury), ♀, respectively.

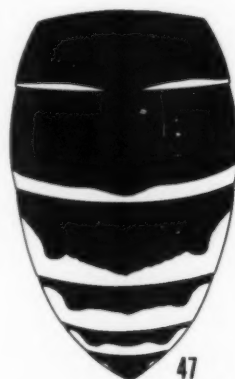
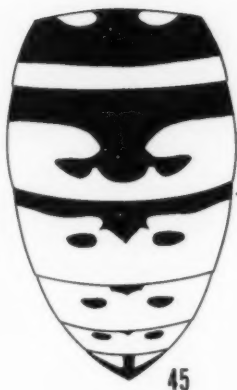
Figs. 79-84. Facial color patterns of *Vespula sulphurea* (Sauss.), ♀, *Vespula albida* (Sladen), ♀, *Vespula arctica* Rohwer, ♀, *Vespula arenaria* (Fab.), ♀, *Vespula norvegicoides* (Sladen), ♀, *Vespula maculata* (Linné.), ♀, respectively.





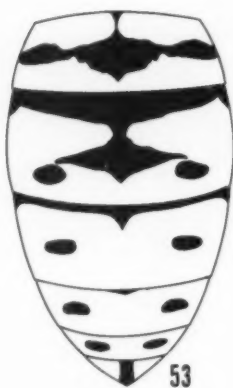
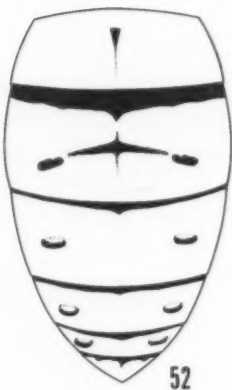






NO







NO





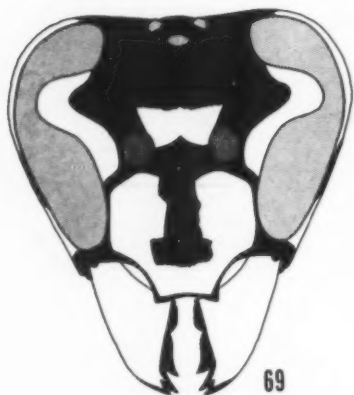
66



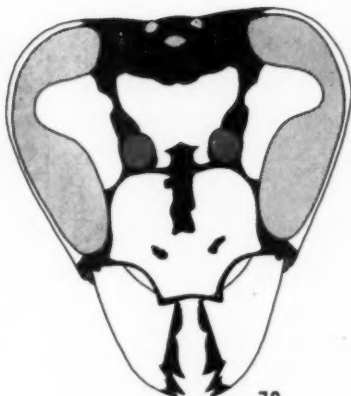
67



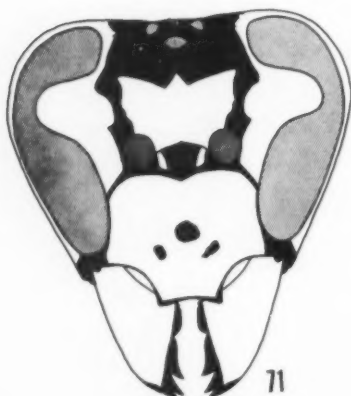
68



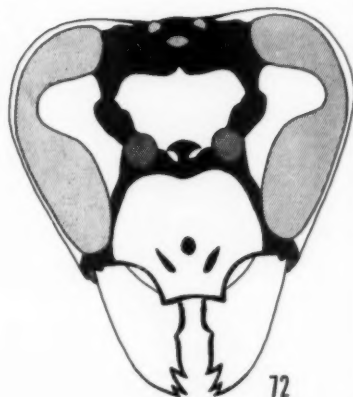
69



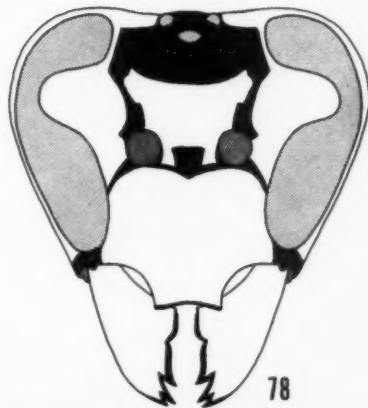
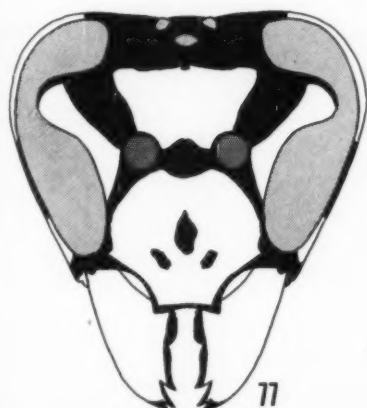
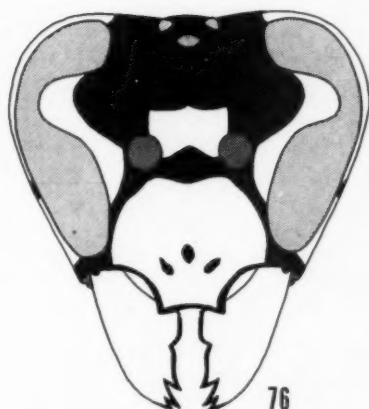
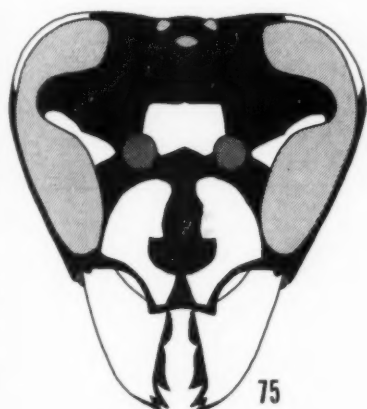
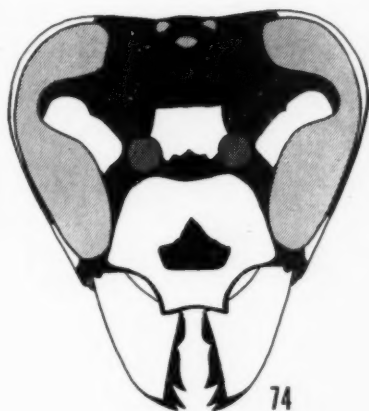
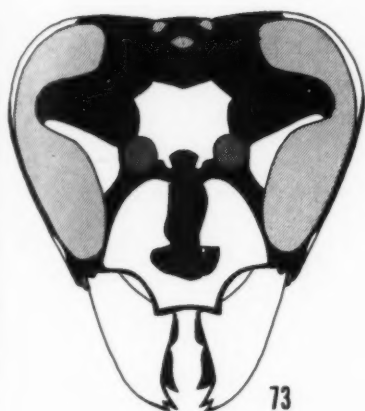
70

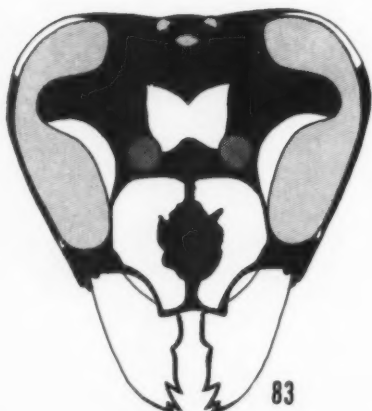
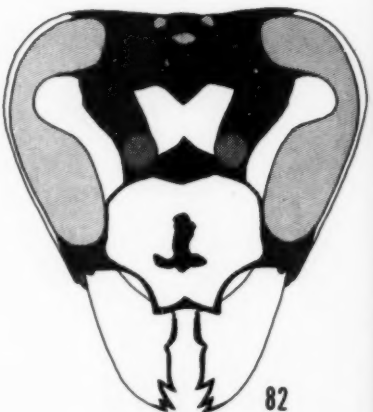
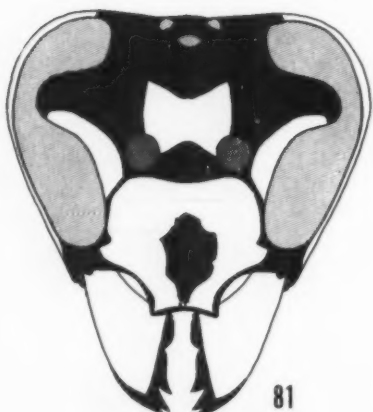
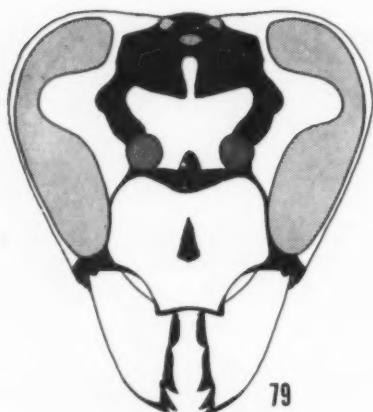


71



72





THE RUNGE PRESS LIMITED, OTTAWA

Mailed: Friday, May 12, 1961

